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TELEPHONE ENGINEER

VOLUME XXVI FEBRUARY, 1922 Number 2

Strowger Automatic and the Director

The Board of Directors of a telephone operating company is not so much concerned with operating duties or service standards as with the maintenance of a proper financial status. So long as the equipment and operating methods used are effective in maintaining an adequate rate of return, the greater part of their responsibilities are met.

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The simplicity of mechanism in these desk stands is the feature worthy of your attention.

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The No. X69 Magneto Wall Telephone is made up with enclosed gongs—a new arrangement of parts—the latest standard practice. Smaller and neater cabinet.

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The No. 114 Automatic Telephone is made up with an off-center stand of exceptionally pleasing design, and with correct mechanical construction. This instrument should be investigated by the manager of every automatic exchange.

No. 114

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GENERAL OFFICES:
28 E. JACKSON BLVD.
CHICAGO, ILL.
TEL. HARRISON 4000

TELEPHONE ENGINEER

EASTERN OFFICE:
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TEL. VANDERBILT 3695

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Valuation in Rate Making

One of the Country's Foremost Authorities Starts A Series of Practical Articles of Interest to Executives of Both Large and Small Companies

By Charles W. McKay

CHAPTER I.

WHY APPRAISALS ARE NECESSARY

Foreword — The consideration of new subject matter—whether it be in serial article form or in book form—always raises a pertinent question in the mind of the thoughtful reader. He wonders if he will ever be repaid for the time and effort spent in perusing the subject matter in question.

The writer and the publishers of TELEPHONE ENGINEER have but one thought in mind in offering this series to you—the presentation of an intricate, but most important, subject in such form that the reader cannot help but glean a maximum amount of money-saving, useful information with a minimum expenditure of time.

If you are the owner, or executive, of a small telephone company you will find, from reading this series, that many relatively expensive steps in appraisal work can be performed by your own forces—at a comparatively small cost. The old saying has it that "a penny saved, is a penny earned"—and this is especially true in these days of financial reconstruction.

If you are an executive, or an engineer, of a large telephone company you will doubtless agree that the thoughts of others, who have been confronted with similar valuation problems, are bound to prove helpful. This series includes a discussion of the many perplexing problems which are constantly confronting the larger telephone companies.

CHAS W. McKAY
Valuation Author Who Begins in This Issue Helpful Series on Valuation.

Uses of an Appraisal—There are numerous uses to which an authoritative, properly prepared, appraisal may be put. In fact, appraisals were made long before rate regulation was even thought of. The sale, purchase or amalgamation or telephone properties always calls for an authoritative statement of property values—and, naturally, such a statement may be had only through the medium of a properly prepared inventory and appraisal. Again, even before the days of rate regulation, appraisals were made for financial purposes. A telephone company wishing to borrow money to finance plant extensions and betterments would naturally apply to his banker for the necessary funds. One of the first questions asked by financial underwriters, in such cases, is "what is the property worth today—what security are you offering me for the money you are asking me to lend you?"

Another use of the telephone appraisal—and probably the most important one, prior to the advent of regulatory measures—is in connection with the determination of property values for purposes of taxation.

With the advent of regulatory measures for the control of the telephone utilities came the demand for accurate and authoritative valuations for two purposes—additional to those enumerated in the foregoing paragraphs. Appraisals were needed in connection with rate regulation and as a basis for establishing, and maintaining, uniform systems of accounts—such as have been prescribed by Public Service Commissions.

To summarize, then, there are five important uses of the modern telephone appraisement. These uses are:—

1. Appraisals for use in connection with rate regulation.
2. Appraisals for use in connection with sale or consolidation of properties.
3. Appraisals for financial purposes
4. Appraisals for use in connection with taxation.
5. Appraisals to serve as a basis for the establishment and maintenance of uniform systems of accounting.

Pre-Commission Rate Making—In the early days of telephony two factors, and two only, entered into the problem of rate-making: the rates charged for telephone service must be high enough to pay satisfactory dividends to stockholders and still low enough to obviate loss of business through competition. At that time, nearly every town and city had two competitive telephone systems—the "Home Telephone" and the "Bell Telephone." For many companies, "those were the good old days"; problems of depreciation, depreciation reserve and the establishment of rates under commission supervision were comparatively unknown.

Editor's Note: Charles W. McKay, formerly president of McKay & Sherman, and at one time identified with the American Appraisal Company of Milwaukee, as engineer of their Public Utilities Department, has been engaged in engineering and appraisal work since his graduation from Sibley College of Mechanical Engineering, Cornell University, in 1906. In July of that year, he entered the employ of the New York & New Jersey Telephone company (now the New York Telephone company) and after serving a brief apprenticeship in the maintenance department was assigned to the plant-engineering department. He was appointed engineer for the North Brooklyn district in 1909 having charge of the preparation of plans and estimates for all outside construction work within the district. In 1910, when the New York Telephone company obsorbed all of the upstate Bell companies, Mr. McKay was assigned to special work and spent the greater part of the following year in inspecting a number of the larger of the company's newly-acquired properties. In 1911, he was appointed engineer of the Borough of Queens. During the year 1912-13 Mr. McKay was associated with Henry Floy as assistant engineer, and was identified with several important appraisal cases. In 1913, he became affiliated with McMeen & Miller, Chicago, and while with this firm, spent the major portion of his time on problems involving appraisement of public utility properties. He later engaged in valuation work for the Central Union Telephone company and continued until his appointment with the Cooley & Marvin company, later serving L. V. Estes, Inc., in charge of their appraisal department for nearly two years. He is a prolific writer on appraisal subjects and has contributed extensively to the technical press. He also is author of "Telephone Rates and Values," one of the industry's most popular books. At present, Mr. McKay is engaged in consulting engineering.

Origin of Rate-Regulatory Measures—With the advent of the public service commission form of public utility regulation, the old dividend-on-stock method of rate setting rapidly fell into disfavor. The reason for this will be obvious: value, or even investment, was rarely found to be commensurate with the value represented by the outstanding stock. Discriminatory rates would, therefore, inevitably have resulted if investment —as reflected by security issues—had been used as a basis for determining true rate-base values.

The history of the evolution of the modern Public Service Commission is most interesting. Many people think that utilities commissions are a product of the twentieth century. Strictly speaking, perhaps, they are—but it is interesting to note that as early as the thirteenth century the British government supervised the dispensation—or rather the prices charged for—many commodities. Of course, in those days the commodities with which our modern Public Service Commissions are chiefly concerned—telephone service, gas, electric light, and electric railway service were nonexistent. The commodities which chiefly concerned the British Government then were tobacco, foodstuffs, etc. It is interesting to note, however, that our modern Public Service form of utility control was contemplated even as early as the Fifteenth century. At that time a commission was formed to set a schedule of rates which should be charged by boatmen for ferrying passengers and freight across the river Thames. The act of Parliament which established this commission, or committee, further stipulated that schedules of rates should be prominently displayed in public places. Furthermore, it was ordered that the boatmen should select a committee of eight from among their own numbers to serve as inspectors; it being the duty of these inspectors to report violations of the law, and departure from the authorized rate schedules, to the London Board of Aldermen for arbitration. Thus it would seem that the Mayor of London and Board of Aldermen served in a capacity very similar to our modern Public Service Commissions.

The scheme, just discussed, worked so well that Parliament felt justified in passing another act, a few years later, providing for the establishment of a uniform schedule of rates to be charged for the transpartation of freight by wagon. In this case, however, the authority for the enforcement of the law was entrusted to the various county judicial authorities. The county judges, therefore, really served in a capacity very similar to our present Public Service Commission.

In our own country, an effort was made in the same direction during the eighteenth century. Schedules of "fair charges" were prescribed for various classes of mechanical work and, about same time, the prices of such commodities as liquors, tobacco, and foodstuffs were legally regulated.

To the writer, at least, all of this is very interesting in that it evidences a predisposition on the part of our ancestors to do exactly what we have done during the latter part of the nineteenth and the early part of the twentieth centuries—i. e. exercise supervision over certain classes of commodities and prescribe definite tariff schedules governing the sale of those commodities.

The public service commission, as we know it today, was really originated in Massachusetts in the early sixties.

Scope of Activities of Public Utilities Commissions—The duties of the modern public utilities commission are manifold. In general, it may be said that the function of a state public service commission includes the

supervision, and regulation of the activities of the following group of utility industries:

Railroad, steam and electric.
Electric light, power companies.
Gas companies.
Water companies.
Central heating companies.
Telephone and telegraph companies.
Warehouse, grain-elevator and dock companies (in some States).
Express companies (in some States).

In dealing with these groups of companies the work of the commission may (in a very general way) be subdivided into the following classifications:

1. The supervision and regulation of the character of the service rendered by the various companies.

2. The determination of fair rates to be charged for service rendered.

3. The supervision of the issuance of securities.

4. The establishment of uniform systems of accounting and supervision over the various companies' work —to the extent of seeing that they adhere strictly to the uniform system of accounts as prescribed.

5. General supervision over expenditures for new plant—or appreciable expenditures for wholesale rehabilitation of old plant.

The so-called utility companies have become such important factors in community development that it may not be amiss to pause for a moment and consider, briefly, just what is included under these various classifications of commission activity.

Regulation Of Service. Perhaps one of the most important functions of the state public service commission is to see that utility company patrons receive the very best service that it is possible for the operating company to furnish. Obviously, no matter how low the rates may be, telephone service is practically valueless unless it is maintained at a high standard. A comparatively few years ago telephone service in France was relatively cheap —but there was a surrent saying: "If in a hurry to deliver a message, hire a taxicab." Fortunately, for us, it is well nigh impossible now for any operating utility company to render service that would fall in that category. I do not mean by this that there are many companies who would render such service—even if they could. However, the public and the companies themselves are usually well protected by the present system of commission supervision of service.

The function of the commission, as far as the telephone companies are concerned, includes the making of tests by service inspectors—the purpose of these tests being to determine what delays, if any, are made in completing subscribers' calls and to determine the percentage of errors made by telephone operators in giving wrong numbers, etc.

Rate Regulation. To the writer's mind the most important problem confronting the modern public service commission is the prescription of rates that will be fair to the public—and still allow an adequate return to the operating company. Rates that are too low are just as undesirable as are excessive rates—this both from the standpoint of the operating company and, in the long run, from the standpoint of the telephone subscriber. If the rates are too low the telephone company cannot make proper provision for plant maintenance; cannot build up a depreciation reserve adequate to replace worn-out and obsolete plant and cannot pay wages high enough to attract competent labor. No matter how good an equipment a telephone company may have, this equipment is well nigh useless unless the personnel of operating organization is maintained at a high standard.

Issuance of Securities. During the war, public interest in utility securities, as an attractive investment, suffered a marked decline—due largely to the temporary popularity of the "War Babies"; or, in other words, those industrial securities which seemed unusually attractive because of their high earning power. Now, however, public utility securities are rapidly regaining the enviable position they enjoyed for a decade, or more, before the war.

One reason why public utility investments always have been popular with conservative investors is that all utility bond or stock issues are carefully supervised by the various state public service commissions. When a telephone company applies for the right to make a loan, or to float a new stock issue, the activities of the company in question are carefully investigated; every effort made to determine whether or not the funds desired are really essential to the betterment of service and, what is most important from the investment standpoint, it is determined whether or not the company has sufficient tangible assets to adequately protect the interests of the investors.

Uniform Accounting Systems. Obviously, if every telephone company were allowed to keep its accounts in accordance with its own ideas a variation of practice would result that would render the task of commission supervision of company activities well nigh impossible—regardless of the individual merits of the accounting systems in use. Hence, one of the first tasks undertaken by most of the state public service commissions was to devise, and install, uniform systems of accounts. Fortunately for the commissions—with the possible exception of the old ones—the Interstate Commerce Commission had already devised an admirable accounting system and this could be, and as a matter of fact in most cases was, used as a basis for laying out systems of accounts to be used by the companies falling under the jurisdiction of state commissions.

Regulation of Capital Expenditures. The regulation of capital expenditures is not quite so important from the standpoint of the telephone industry as it is, perhaps, from the standpoint of the electric utility interests. Electric light companies are very often competitive — one frequently finds two or more companies in one city. In such cases, one company may wish to extend its plant into territory which is already adequately served by a competitive company—for the obvious purpose of obtaining new business. This may be very well from the standpoint of the company but it entails an expensive duplication of plant and thus places an additional burden upon the community in question, without in any way improving the service or benefiting the subscribers.

To some extent, the same may be said of telephone companies—where one company, wishes to extend its plant into terirtory of a rival company, for the sole purpose of "proselyting."

Under the commission form of utility control, public nuisances of this nature are not possible. Each company, desiring to expend money for plant extensions, must apply to the state public service commission for authority to do so. The commission in question, if it is on to its job, will carefully investigate the entire situation before granting the necessary permission.

A pioneer in public service commission work, Mr. Halford Erickson, formerly chairman of the Wisconsin Railroad commission, has expressed himself so clearly on this phase of utility

commission activity that it seems well worth while to quote him at this juncture. Mr. Erickson says:

"There is one more field in which the commission has an important function in promoting the highest efficiency and lowest cost of public utility service. This is in the prevention of duplication and waste in the establishment and extension of both railway and municipal utility plants. It is recognized by the railroad and public utility laws of Wisconsin that public service corporations are in their nature monopolies, and that the interests of the public are best conserved by protecting monopoly in these industries, and at the same time supervising and regulating them in the public interest. To carry out this purpose, competition among public service companies in the establishment of new lines and plants is prohibited except under such conditions as make its existence a benefit to the public.

By keeping fairly close rein on the investment of capital where another investment has already been made for the same purpose, and at the same time permitting such extensions and even duplication as will result in the greatest development of profitable business and the widest diffusion of needed services among the public, the commission's regulation of capital expenditures is capable of producing very beneficial results to investors and a permanent advantage to the consuming public."

Commission control plays so important a part in the presentation of our present subject that, before leaving the general subject of commission activities, it may be well to briefly review the history of several of the leading commissions—especially in view of the fact that the decisions of these commissions are constantly referred to in the subsequent installments of this series.

Perhaps the oldest commission is the Massachusetts commission—founded in the early sixties. In 1885 the Board of Railway commissioners, as this commission was called, was changed to the Massachusetts Gas and Electric commission which, as the name applies, had jurisdiction over the gas and electric companies as well as over the railroad companies. Up until the year of 1913 telephone and telegraph companies were supervised by another commission, The Massachusetts Highway commission. In that year (1913), the Massachusetts Public Service commission was created—superseding the old commissions. During the last eight or nine years the Massachusetts Public Service commission has been very active in problems involving rate regulation.

Another famous commission, from an historical standpoint, is the Wisconsin Railroad commission created in 1905. At first, this commission had jurisdiction over the railroads, only, but subsequently the scope of its activities was enlarged to include the telephone, telegraph, electric, gas, water and express companies. The Wisconsin commission is famous for its pioneer work in connection with the solution of valuation and rate problems. Its decisions on this subject are extensively quoted—as will be noted in the subsequent installments of this series.

Until very recently there were two commissions in New York State. The commission for the First District supervised the activities of all of the public service companies in New York City—except the telephone company. This commission had its headquarters in New York City. The commission for the Second District supervised the telephone interests in New York City and all of the public service companies outside of New York City. This commission had its headquarters at the State Capital in Albany, New York. The New York Commissions have both done a large amount of constructive work in matters pertinent to the solution of valuation problems.

Many of the other state utility commissions have done excellent work in setting valuable precedent in the adjudication of rate cases. We have neither the time nor the space, at this juncture, to review the work of these commissions in detail. For the present, suffice it to say that the California, Washington and Oregon commissions have done some very interesting work—in conjunction with the engineers and attorneys of The Pacific Telephone & Telegraph company—in evolving a comparatively new theory of valuation, known as the "Actual Performance Theory". Regardless of whether or not we subscribe to the fundamental principles underlying this theory, the theory itself is most interesting and will be made the subject of a more detailed discussion in a subsequent installment of this series.

Function of the Appraisal in Rate-Making. In the early days of commission regulation, the commissions were somewhat at a loss to find a method of determining fair property values. Regulatory bodies soon found that capitalization—as represented by outstanding security issues—rarely represented true property values.

The next plan that suggested itself, to the pioneer public service commissioner, was the investigation of the books and records fo a utility company, with a view to determining the actual original investment in plant and equipment. For many reasons this method, also, proved unsatisfactory. In the case of the older companies, records of original cost were frequently missing. Again, due to imperfect accounting systems moneys expended for new plants were frequently charged to the operating, rather than to the capital, accounts.

Discouraged by their ineffectual efforts to obtain a true measure of property values—by the investment, original cost and capitalization methods—utility company engineers and commission engineers combined forces in the evolution of a method which would afford a reasonably accurate index of property values. The "Reproduction Cost Method" resulted.

"Reproduction Cost", as the term implies, refers to "an assumed value based upon the estimated cost of replacing a property new on the basis of prices current at the time of the estimate,—prices that fluctuate considerably are averaged for five years preceding date of appraisal,—and is made up to include everything that can be inventored regardless of original cost, age, service value or present condition as affected by depreciation". This definition of Reproduction Cost was advanced by Mr. Henry Floy—a pioneer writer on the subject of Public Utility Appraisment.

The function, then, of the appraisal in rate-making is to afford a method of determining fair property values. As a rule, the physical plant and equipment is first inventoried and then priced out on a reproduction cost basis. Coincident with the task of inventory, the appraisal engineer makes a careful study of the actual present condition of each element of physical property. The purpose of this study is to provide a means for depreciating the reproduction costs to reflect the actual present values at the date of appraisment.

The use of the appraisal in determining fair values for rate-making purposes is a most important one—and, in fact, the determination of physical and intangible property values is one of the most difficult problems that enters into the Science of Rate-Making. Original cost, where available, also is frequently considered in determining a fair rate-base value. In many instances the process of determining original cost is

very similar to the reproduction cost appraisal process—as will be shown in a subsequent portion of this series.

In the famous Manitowoc Water Co. case, the Wisconsin Railroad Commission aptly summarized the function of the appraisal in rate-making as follows: "In determining the value of the physical property of a public utility, several elements must be taken into consideration. The three elements of greatest importance in fixing the value of such plants are: the cost of reproducing the plant; the present value and the original cost. As to which of these elements shall be given the greatest consideration must depend upon the circumstances in each case, and must also depend upon the purpose for which the valuation is made."

In concluding the present installment attention is invited to the fact that a preliminary discussion of "whys and wherefors" is essential to a clear understanding of any subject. So, if the present chapter seems to indicate a theoretical, rather than a practical, trend of thought—do not be discouraged. The next chapter entitled "The Fundamentals of Telephone Appraisment" leads us directly to a consideration of the more practical phases of Telephone Evaluation.

LIFE OF PLANT UNITS.

Illinois Tables Showing Life of Various Classes of Telephone Property.

Tables, showing the life of various classes of telephone property, have been prepared by the Illinois Telephone Association for the information of the companies of the state in connection with the Interstate Commerce Commission's questionnaire on Depreciation. Secretary Jay G. Mitchell, in the circular prepared by the Association, points out that the Interstate Commerce Commission wants the experience of each company and that the tables are not to be used where the company has its own individual experience to give. If, however, the company does not have information, based on individual records and experience, it is advised to study the table and prepare a similar table using its best judgment in adapting the figures to its own conditions. In case the table is used, it should be stated explicitly that a life table was used in arriving at the estimated life. The following table gives the summary of the information collected by the Illinois Association:

Class of property.	Suggested limits between which lies estimated average service life (years) (per unit).	Suggested maximum estimated salvage value (per cent. of original cost).
Aerial cable exchange	13.0-16.6	16-25
Aerial cable toll	20.0	30.0
Aerial wire copper exchange.	11.5-20.0	30-57
Aerial wire iron exchange	11.0-16.0	None
Aerial wire insulated exchange	10.0.12.0	None
Aerial wire copper toll	28.6	35
Aerial wire iron toll	13 0-16.0	None
Aerial wire loading coils toll.	*20.0	None
Buildings	15.0-40.0	15-25
Frame	15.0-25.0	15-25
Concrete block and tile	35.0-40.0	15-25
Brick	40.0	15-25
Booths and special fittings	16.0-16.5	None
Central office equipment	10.0-15.0	3-2
Franchises	legal life	None
Furniture and fixtures	8.0-15.0	None
General shop equipment	*5.0-10.0	None
General store equipment	10.0	None
General stable and garage equipment	5.0-6.0	6.8-10
General tools and implements	5.0-8.0	10%
Interior block wire	13.0-16.6	None
Interest during construction.	composite plant life	None
Other intangible capital	composite plant life	None
Pole lines exchange	12.0-17.0	None
Pole lines toll	14.2-14.4	None
Private branch exchanges	16.0-16.6	5-12.1
Patent rights	legal life	None
Right of way exchange	16.6	None
Right of way toll	16.6	None
Subscribers' sta. apparatus.	10.0-19.0	5-12.1
Subscribers' sta. installations	16.0-16.6	None
Submarine cable exchange	14.2	None
Submarine cable toll	*9.0-12.0	None
Underground conduit exchange main	22.0-50.0	None
Underground conduit exchange subsidiary	*15.0-20.0	None
Underground conduit toll	50.0	None
Underground cable exchange main	14.0-31.8	25.3-39
Underground cable exchange subsidiary	*13.0-20.0	25.3-39
Underground cable exchange loading coils	*20.0	None
Underground cable toll	33.3	30
Underground cable toll, loading coils	*20.0	None

Ohio Independent Telephone Convention at Columbus, March 29-30.

The annual convention of the Ohio Independent Telephone Association will be held at the New Southern Hotel, Columbus, Ohio, Wednesday and Thursday, March 29–30. Many important questions confront the operating companies, and arrangements are being made for a program that will cover these problems. Hotel accommodations will be better than in previous years, and a record attendance is anticipated. A cordial invitation is extended all telephone men to attend.

Kellogg Has Third Largest Year in 1921 Total.

Chicago, Ill. — Kellogg Switchboard and Supply Compny sales for 1921 were $5,252,000, which, although but 62% of the sales of the previous year, was the third largest mark in the company's history, having been exceeded in 1919, as well as in 1920.

"Happy" Crawford Joins the Everstick Anchor Co.

Victor L. Crawford, or "Happy" as he is more generally known throughout the telephone, telegraph and electrical industries, has joined the Everstick Anchor Co., of St. Louis, Mo. This old establishment, headed by Jasper Blackburn, makes a number of successful specialties and has others on the way. Its products at present include the Everstick anchors, Neverslip cable hangers, Blackburn boltless guy clamps, messenger splicers and strain insulators. The Neverslip Hangers are applied by hand; no tool required. They fit ¼ to ½ strand. Neverslip Hangers can be installed over or removed from an existing cable without injury to the Hanger or strand. It is claimed, also, that they never become junk.

"Plastic Conduit Joint Wrapper Meets Big Need"—Irish.

Philadelphia, Pa.—E. J. Irish, maker of the Hercules Plastic Joint Conduit Wrapper claims he has the answer to the call for a waterproof covering for conduit joints, in his Hercules product. The Hercules wrapper is constructed on a light, but strong, twine base, covered with a pulp surface and treated by a special process which makes it adhesive. The Hercules wrapper is claimed to hug the conduit so tightly cement at the joint is unnecessary. Hercules wrapper is handled on reels, so waste is prevented. Mr. Irish claims Hercules plastic conduit joint wrapper is instantly available for use, waterproof, adhesive, labor saving, acid-proof, light, flexible, non-elastic, and economical.

Next Meeting of Florida Association at Tampa, March 2-3

W. G. Borein, president Florida Telephone Association announces the next annual convention for Tampa, March 2 and 3. Manufacturers of telephone equipment and supplies are requested to make arrangements early for exhibiting their products.

Only One Regular Radiophone Service in England at Present.

"Electricity," a British magazine, states that the only regular wireless telephone service in that country is that between the Mersey Docks and Harbor Board Office and the Bar Lightship, situated about a dozen miles out in the Irish Channel.

Western Electric Museum

Bell's Original Telephone—Reiss Transmitter, 1861—Van Der Weyde Transmitter—First Subscriber's Telephone—Wire Coil Used in First Transmission of Speech—Milestones Along Telephony's Path of Progress

By Ottmar Sardou

To the casual visitor at the British museum, a certain yellowed piece of parchment may be only one of many similar exhibits that hold the attention for a moment because of their evident antiquity, beauty or quaintness. To the student of history, however, this document is a guidepost on the road down which civilization has marched through the centuries; a monument marking an event which ended years of thwarted aspirations for fuller freedom; the beginning of the slow but resistless progress of Englishmen, and of the human race at large, toward that liberty which they now enjoy—one of the four existing exemplars of the Magna Charta.

In a glass case at 463 West street, New York, is a piece of wire. It is one of many hundreds of exhibits assembled there by the American Telephone and Telegraph Co. and the Western Electric Co., which maintains this unique museum as an adjunct to the research laboratories of the Bell System. It is, to all appearances, a very commonplace piece of wire, its cotton insulation somewhat faded in spite of the glass that protects it; its ends a trifle frayed.

But, as certainly as the Magna Charta marks an epoch in the history of human freedom, this bit of copper wire marks a point in the history of communication at which Science came to a parting of the ways, made its momentous decision and forever after traveled over a new and untried road. It is a section of the wire over which, on March 10, 1876, Alexander Graham Bell spoke to an assistant in another room the sentence that was to become the Magna Charta of the telephone. What the barons wrote at Runnymede was not in itself as significant as the fact that they wrote it—and that King John signed it. What Bell said that March day was a commonplace: "Mr. Watson, please come here, I want you!" But it became momentous—because Watson heard it.

A Journey Through Telephony's Wonderland.

Backward from that bit of wire stretched years of groping in the dark for the secret of speech transmission. Forward from it, stretches a path along which, with faltering steps at first, the art of telephony has made its way. It is of milestones along this path that one who knows even a little of the romance of the telephone's remarkably history instinctively thinks as he wanders from exhibit to exhibit in the Western Electric museum. From that historic bit of wire extends a series of exhibits which, step by step, mark the progress of the art during its wonderful forty-five years. The visitor may well direct his attention first to those exhibits which typify the period of uncertainty that immediately preceded Bell's discovery of the principle of employing the undulatory current in the transmission of sound. He will see models of instruments made by Philip Reiss with which, in 1861, this German scientist succeeded in transmitting musical sounds by the simple "make and break" method, but failed in his attempt to make of a wire an avenue over which speech might travel. Hardly less interesting are facsimiles of instruments with which Van der Weyde, a Hollander, sought unsuccessfully for the solution of the same problem. Only an examination of these exhibits can prepare the visitor for those with which the museum's inspection usually begins—the reproductions of the transmitter and receiver with which Bell first succeeded in transmitting the sound of the human voice by means of an electric current. Before passing to these epoch-making milestones, however, one should stop for a moment to examine the exhibits which symbolize Bell's own awakening to the fact that he had found the solution of his problem. Among these is the apparatus by means of which he produced the manometric flame,——a gas flame which was made to fluctuate by transmitting to its control the vibrations

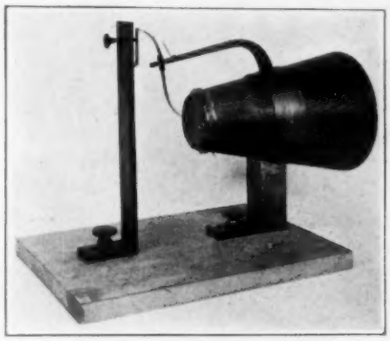
In This Room is the World's Greatest Exhibit of Babyhood Relics of the Telephone.

of the air caused by the human voice. This Bell had used in an effort to teach his deaf pupils to use their voices by reproducing for them a series of pictorial symbols of sounds, commonly known as visible speech—an effort in which the young scientist was but following the footsteps of his father, himself a distinguished student of the science of acoustics.

Bell's Discovery Aided By Accident.

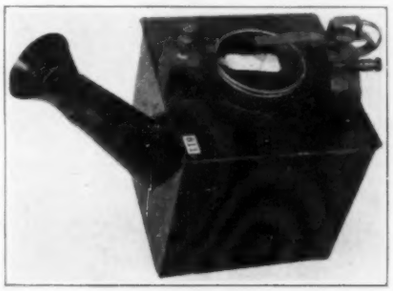
Photographs made by means of the apparatus in which Bell and his friend, Dr. Clarence J. Blake, a noted Boston aurist, employed the bones of a human ear and a straw to make tracings upon a moving strip of glass coated with lampblack, constitute interesting and important contributions to this portion of the history of the telephone. Finally the seeker for romance will pause for a moment at the model of the harmonic telegraph upon which Bell and his young assistant, Thomas A. Watson, were working when, on June 2, 1875, the accidental twanging of a reed made from a bit of clockspring was distinctly heard over the wire and started Bell building the air castle which was to materialize in the telephone system of today.

But a few inches of glass shelving separate this exhibit from the next—the crude instrument over which intelligible speech was first transmitted. In point of fact, the two were divided by months of tireless and often disheartening experimentation, during which at the insistence of Hubbard and Bell's other financial backers, the young scientist was obliged to spend most of his time on the harmonic telegraph, robbing himself and his assistant of much needed rest in order to "steal" time to work on the apparatus that was later to become the telephone. Another early telephone milestone is a model of the instrument exhibited by Bell at the Philadelphia Centennial, which so thrilled Dom Pedro, emperor of Brazil, that his startled ejaculation, "My God, it talks!" has become historic. It became the marvel of the exposition over night when Sir William Thompson, the great English scientist, gave to Bell his unstinted commendation. A model of Elisha Gray's liquid transmitter cannot but fascinate one who knows the story of the filing of the latter's *caveat* on the same day on which Bell applied for his original telephone patent. Nor will the student of telephony fail to find interest in Gray's "blacking-box" receiver or his "organ-pipe" and concave diaphragm transmitters, the latter of which, if not actually made from an old-fashioned iron wash basin, is strongly suggestive of that plebian utensil in appearance. Nor will another series



Reiss Toiled and Thought This Transmitter into Being.

of exhibits fail to interest one who has read of the efforts of tremendous financial resources and a great scientific triumvirate, to crush its new rival by entering into direct competition with the little company which Bell's backers had organized. This series includes models and originals of the instruments produced by this competition and put on the commercial market.



This was Van der Weyde's Idea of a Transmitter.

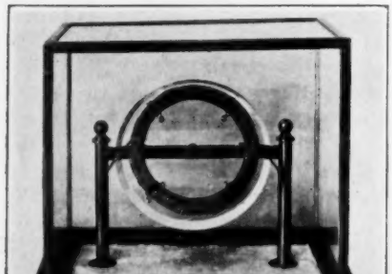
Blake's Transmitter Comes to Bell's Rescue.

Neither the financial powers nor reputation of the scientists disturbed Bell and his circle of telephone enthusiasts. But they were frankly concerned over the fact that the transmitter which the competition had produced was actually a better transmitter than that which they were attempting to use commercially, with far from encouraging results. The answer to their fears came in the Blake transmitter, the adoption of which marked another turning point in the road over which the art of telephony was beginning to make its slow but steady progress. To the close student of telephone engineering, the series of exhibits illustrating the development of the transmitter from the first Blake instrument to the present Western Electric instrument, No. 323, which cannot be here described in detail, is of intense interest. Similarly, one who examines them with the proper technical background can see the significance of each successive change in the series of receivers exhibited in the museum, which shows the transition from the crude and cumbersome affair of Bell's time to the receiver commonly used throughout the Bell System today. The development of switchboards is not less interesting. From the rough, handmade board which E. T. Holmes of Boston, back in 1877, made do double duty as a telephone system by day and a burglar alarm by night, the path stretches, each foot of progress marked by an exhibit showing a development of some one of the thousands of parts which constitute the modern multiple, common battery board. Of particular interest is the original Western Electric universal switchboard, made under the Scribner patents in 1879, from which the modern switchboard was developed. The visitor cannot fail to find interest, too, in following two curious "bypaths" leading away from the line of switchboard development that are illustrated in the Gilliland cordless switchboard used in Golden, Col., in 1880–81 and the Law board, used in St. Louis in 1888. As a matter of fact, his progress along the road of telephone development as marked by the museum exhibits is made all the more interesting to the visitor by some of these curious departures from the main highway—the Phelps "double crown" transmitter, for example, a cumbersome affair of cast iron that cannot but bring a smile to the lips of one who is familiar with the compact and ornamental desk set of the present day. Nor will the modern telephone girl fail to wonder at the operator's headpiece known as the Gilliland harness—a piece of apparatus that strongly suggests the Iron Maiden and kindred medieval instruments of torture.

American Science Outstrips the World.

The contrast between the boasted scientific ability of the German and the rough and ready, but resultful, ingenuity of the American is well illustrated by comparing the contents of two cabinets, one of which is filled with captured German field telephone paraphernalia almost unbelievably clumsy in design, while the other contains specimens of wireless telephone equipment developed by Western Elec-

tric engineers for use in airplanes during the war. When it is remembered that not only the Germans but the best scientists of the Allies had struggled unsuccessfully for three years with the problem of adapting the wireless telephone to the exacting and

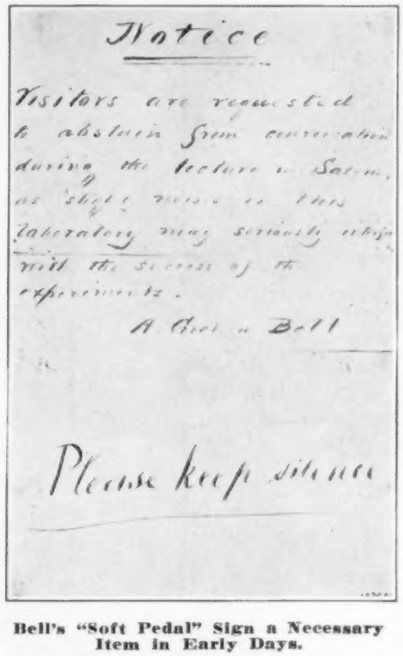


With this Apparatus Bell Triumphed in Speech Transmission.

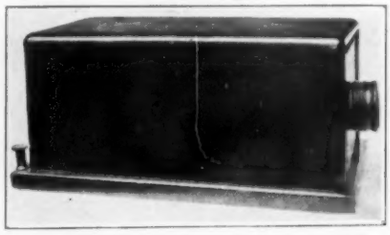
strenuous conditions of aircraft use and that the solution of this problem was finally found only when America entered the war, one sees new significance in these milestones on the highway of telephony. The progress of the art has not been without its obstacles, as several exhibits silently attest. Every telephone man knows the danger of sleet storms, but not every one knows how serious these dangers can become until he sees a plaster cast made from a sleet-covered wire that fell during a blizzard in Boston in 1898, in which the cylinder of ice is shown to have been several inches in thickness and to have reached a weight of several pounds to each foot of wire. Vaguely every telephone man knows that certainly lower animals are the relentless foes of successful transmission, but not many have seen unless they have visited the Western Electric museum the results of the industry of the Chinese woodcutter bee, which has made all sorts of trouble for the Shanghai Mutual Telephone Co. by mistaking its lead-covered cables for the bamboo stalks in which the insect usually lays its eggs. A specimen of the bee and of a cable into which it has mysteriously bored its way are shown in the museum. But in spite of bypaths which have branched off from the main track and of obstacles which have temporarily impeded the telephone's progress, the line of advance is clearly defined. Whether it is switchboard plugs and jacks that hold the visitor's attention, or sections of cables, or vacuum tubes, or the design of desk set stands, the separate exhibits, like so many footprints, point always forward.

Some Souvenirs of Epochal Events.

Here and there the milestones along the line of march become monuments commemorating some event of particular significance in telephone history. It is fitting that one should find in a cabinet only a few feet from that which contains the facsimiles of Bell's crude instruments, the desk set used by Theodore N. Vail in talking to President G. E. McFarland on the morning of July 29, 1914, when the human voice first sped across the continent, and that the instruments



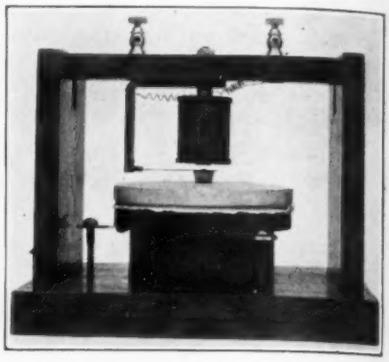
Bell's "Soft Pedal" Sign a Necessary Item in Early Days.



Here's What the First Subscriber Got as a Set.

Switchboards Sure Have Changed. This is the First One Made.

used by President Wilson, by Mr. Vail, by Dr. Bell and by Thomas A. Watson at the formal opening of the transcontinental line should be given places of honor. By the side of these instruments and in significant contrast with them, stands a replica of Bell's original telephone, which was actually used in opening the transcontinental line by Dr. Bell in repeating to Watson his request of thirty-nine years before, "Please come here, I want you", and over which he heard his former assistant in San Francisco, laughingly reply, "All right, Dr. Bell, but it will take me five days!" Finally, one finds a re-



This is the First Telephone Bell Made—A Historic Relic.

ceiver, a vacuum tube, the condenser, transmitter and, suspended from the wall, one of the large wooden sound projectors of the Bell Loud Speaker used during the inauguration of President Warren G. Harding. President Harding spoke in an ordinary tone of voice and this triumph of telephone engineering carried his words to the very edge of the huge crowd that was packed around the Capitol portico where he stood. For a curious and inspiring contrast with this epochal bit of telephone history, the visitor may well turn, before leaving the museum, to a small wooden frame containing a notice, in Bell's own handwriting, which was posted in his laboratory while the young investor was giving a lecture in Salem. It reads:

NOTICE.

Visitors are requested
to abstain from conversation
during the lecture in Salem,
as slight noises in this
laboratory may seriously interfere
with the success of the experiments.
—A. Graham Bell.

"Please Keep Silence"—the visitor has no difficulty in obeying the injunction, for he cannot but have acquired a feeling akin to reverence as he has traced the course of telephone progress during its remarkable forty-five years. He leaves the museum with a conviction that, while his journey past the milestone and monument has ended, that of the art of telephony has hardly more than begun. Indeed, Telephony becomes for him, not merely an art, but a personality, as he sees her standing, with splendid achievements behind her, on the crest of the present, her eyes fixed firmly and confidently upon the road which stretches ahead into the future, with other and more glorious successes yet to be attained.

OPINIONS AND COMMENTS

SPRING CONSTRUCTION; PLAN EARLY.

The year 1922, undoubtedly, will be one of considerable activity in the telephone construction field. This is indicated by the extensive programmes already announced by some of the larger companies. In 1917 and 1918, telephone companies, at the request of the Government, loyally restricted their plant extensions to a minimum to make available supplies of construction material for war purposes. In the year following, high prices of material and almost prohibitive rates for money prevented large extensions to plant. As a result, many telephone plants find that the growth during those years has absorbed practically all of their spare facilities and that extensions now are immediately necessary to care for new business. While there have been no notable reductions in the cost of the material and labor that go into the construction of a telephone plant, the fact that financing now may be done on more reasonable terms is causing telephone companies to reinstate the pre-war condition of being able to handle business as offered by providing a reasonable amount of spare plant. In normal times a well-engineered telephone plant requires a certain percentage of spare facilities so that moves, changes in class of service and new installations may be cared for without too great a delay. This calls for advance planning, and wise telephone managers frequently have been able to construct plant very economically by a well worked out construction programme. In such plans, additional facilities are provided during periods of cheaper material and labor and the plant is worked closer to saturation during periods of high prices. The wise manager has his facilities available when more active business conditions demand them, while the manager who has less foresight has to do his construction during high prices. The telephone is one of the first industries to feel the effect of returning business activity just as it is one of the last to feel a depression. By wise planning of construction during the coming spring, telephone companies can be in shape to care for the business that is sure to come as general conditions are restored to a sound basis. These plans for spring construction do not need to be delayed until the weather is suitable for outdoor work. In fact, the entire spring programme can and should be planned before work is commenced. The facilities of the entire plant can be checked over and, in all cases where more than 80 per cent of the existing facilities are in use, a study can be made to determine if the remaining facilities are likely to be absorbed by growth during the coming year. Plans can be made for relief in these places, quotations on material for the entire program can be obtained and orders can be placed, so that the material will be on the ground when the weather opens up and work may be at once commenced. By planning the entire programme and contracting for the material in lump, substantial savings often may be made. A construction programme of this kind, well planned in advance, will restore the telephone plants of the country to their normal condition of having spare plant available, and there seems to be no good reason why this should not be done during the coming spring, wherever the details of financing can be arranged.

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General Business and Editorial Offices, 28 E. Jackson Blvd., Chicago, U. S. A. Telephone: Harrison 4000.
W. H. Graffis.....Gen. Mgr.
Herbert Graffis.....Bus. Mgr.
Jos. M. Graffis....Advertising Mgr.
E. Klappenbach.....Eastern Mgr.
56 W. 45th Street, New York.
Tel. Vanderbilt 3695

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THE RADIOTELEPHONE

The widespread interest in the radiotelephone which has been aroused by the recent developments in that phase of the communication art has led many telephone men to wonder what effect it will have on the future of the telephone business. While the radio telephone is still in its infancy and while many of the present difficulties will undoubtedly be overcome as its development progresses, there are inherent limitations to this method of communication that make it apparent that in its ultimate development it will supplement rather than supersede the wire telephone. With the single exception of a two-way commercial radio telephone "circuit" from Long Beach, Cal., to Catalina Island, the present use is for the broadcasting of music, grand opera, market reports, church services and public addresses. That it is even now in extensive use for these purposes can be vouched by anyone who has spent an evening in listening at a radio receiving station. While no telephone man need fear that his investment in a wire system will be rendered useless by the radio development, nevertheless, he can not dismiss the matter of the radio telephone as one requiring no further attention. In the nature of things, the local telephone exchange is the center in communication affairs and the telephone man should be the best informed person in his community in regard to radio as well as the ordinary forms of electrical

communication. Every telephone man should interest himself in the radio field so that he will be prepared to take the lead when public interest in the radio telephone is awakened in his locality. In order to do its share to enable telephone men to keep up to date in this interesting and important matter TELEPHONE ENGINEER will publish from time to time articles of general interest on radio telephones and will keep its readers advised of the progress of the art.

MEMORIAL TREES

Poems are made by fools like me
But only God can make a tree.

A sentiment akin to that expressed in these lines of Joyce Kilmer, who himself fell in the Chateau Thierry drive, makes the tree a most fitting memorial for those boys of ours who gave their lives in France. Everyone today, whether he gave much or little in the late war, can assist in establishing such living memorials to those who gave all. But, like many other splendid ideas, the very delicacy of the sentiment behind it may obscure some of the practical aspects of this matter in its application. While all will agreee as to the fitness of the planting of memorial trees, not all will agree that the proper place for them is along the highways, as has been suggested. The modern highway is an unsentimental, utilitarian thing of hard surfaces and easy grades designed for highsped travel. It has little in common with the tree bordered byroad that entices the leisurely traveler away from the high-road to saunter along and enjoy its leaf-shaded pleasantness. It must, also, carry its burden of the wires that have removed much of the isolation and drudgery of life on the farm. It is primarily a thing of use, rather than of sentiment. The highway engineer and superintendent whose duty it is to construct and maintain the road, know the difficulty of obtaining proper drainage and maintaining smooth surfaces and know, too, how the presence of trees add to these difficulties. The farmer well knows the decreased productiveness of a strip of shaded land, two or three rods wide, along a row of trees. The telephone man and the electric light man know the difficulties of maintaining service when trees grow into their lines, and realize the inevitable necessity of mutilating the trees to insure reliable service. All of these men appreciate that increased difficulties will come with the planting of trees along the highways, but many of them have refrained from voicing their protests lest their motives might be misconstrued as selfish. It would be a pity to let anything stand in the way of accomplishing a project of such high ideals, so even those who have foreseen practical difficulties for themselves have remained silent and ready to assume their share of the burden. May there not, however, be some way of carrying out this great idea, without placing a burden on those who serve the public as do the State and County Highway Departments, the farmer and the telephone and electric companies? In nearly every community there is waste of land of some kind; land that has been cut over, or land that is too rough for profitable cultivation. Would it not be possible in many places to set aside some of this land for the planting of memorial trees? Such tracts, as the trees grow larger, would become places of rest and recreation; parts of park systems, or picnic and auto-camping grounds. They could be set aside as bird preserves where man's feathered friends, who find all too few places as civilization extends, may find shelter and nesting places. The idea commends itself, but its working out must depend upon local conditions. In many places, a suggestion, properly directed, might put the plan into effect and the planting of memorial trees, in itself a fine tribute to those who are gone, would also become a permanent benefit to those who remain. Telephone men should have this in mind and, when the matter of planting memorial trees comes up, see that there is proposed these alternative plans to that of placing them along the highways. The alternatives will in no way detract from the suitability of the memorial but, rather, will enhance its value.

BUDGETS—AND BEATING THEM.

The announcement of budgets of expenditures to be made in 1922 by many companies suggests the question as to how many companies outside the associated Bell companies conduct their business on a budget system. The annual budget is a forecast of the year's business and takes in all the factors that enter into it. These include station growth, construction and replacement programme, revenues, expenditures and all other elements. One progressive company during 1920 conducted a "Beat the Budget" campaign. At the end of each month, statements were prepared showing collections, operating expenses, station growth and other items for each district into which the territory was divided, with the percentage above and below the budget computed. With the budget estimate as a target, the entire force took a hand in the shooting. Needless to say, at the end of the year the announcement was made that the "Budget Was Beaten." Doubtless, many other companies follow the budget system but there are many who do not and who could with great benefit engage in the practice.

JOE THE JANITOR.

Joe Erbeldince is the janitor of the Cabany telephone exchange at St. Louis.

Where ordinary janitors are content with a broom, and biceps, Joe adds a brain.

One of the best little exhibitions of the telephone industry's spirit of public service may be credited to Janitor Joe for his article in the family magazine of the Southwestern Telephone Company, on "The Job of the Janitor."

Joe is the arch-enemy of dirt, the heavyweight champ of hygiene, because he makes his job important.

Where Joe works there are but a scant few lean and worried looking bacilli. They haven't a ghost of a show to get a bite at the rosy cheeked girls, or the keen men, in Joe's protectorate.

Let the man who thinks his job doesn't amount to much—talk to Joe and then take a new look at life!

Our Innermost Problems

Financing Extensions—The 14th Amendment—Mistaken Conception of Commission Regulation—Why Hesitate When the Man is Drowning?

By J. C. Kelsey

It goes back 2000 years.

History does not clearly show that Jerusalem had issued any municipal bonds or that any one of the Public Service corporations of the Holy City had any sudden rush of business and was in serious need of straightening out its finances to meet the requirements of a swiftly growing community.

It is well known, however, to readers of Scriptural history that there were money changers in the Jerusalem temple. They were probably private bankers who carried all the deposits of their customers in a bag and who were unpopular as Wall Street is today in the agrarian mind. But, it all goes to show that even then men had to borrow money until they could market the products of their vine and fig tree.

And we know, with further credit to Shakespeare, that Antonio was placed in a most embarrassing position because he had pledged a pound of flesh as collateral for money borrowed to keep the home fires burning until his ship came in.

All this financial evolution has led to discounts and rediscounts and credits which would daze any Shylock of the past.

J. P. Morgan said character was the basis of credit.

But 2000 years ago, another economist—not a financier—gave us another version of what credit means, which every man can and does understand:

"For unto everyone which hath shall be given, and he shall have abundance, but from him which hath not shall be taken away that which he hath.

"And cast ye the unprofitable servant in outer darkness; there shall be weeping and gnashing of teeth."

Needless to tell you, Matthew recorded these wonderful lines, uttered by the homeless Nazarene, as he wandered through the streets of Jerusalem seeking to stir a sleeping world to a sense of economic as well as spiritual fitness.

Is it not true today?

When your company, or any successful company, has more money on hand than it really needs, has it not happened to you that your banker called you up and asked you if you could not use some very cheap money?

Why does your banker offer you money?

Because he knows that you are a money-maker, that you diligently pursue your business, that you have doubled the ten talents entrusted to you, and have not been afraid to ask the proper price for your output.

In other words, you "have, and are given unto, and shall have in abundance."

But reverse the picture:

Your business is bad; you are losing money and your capital account is being impaired every day and hour.

You need money to carry on until such time as you can secure relief and end the drain upon your capital sources.

Does your banker call you up at such a time and ask you if he can credit you with $50,000 cheap money for a few months.

Well, hardly. The fact is you sneak tremblingly into his office, restlessly twirl your hat, your heart in your throat, your feet on ice, while you haltingly relate your needs in an unsympathetic atmosphere.

What does this banker say to your prospects of borrowing his depositors' money under such circumstances?

Your character may be flawless but the mind of the money-changer goes back to that wandering economist, and he says:

"But from him that hath not shall be taken away even that which he hath. And cast ye the unprofitable servant in outer darkness; there shall be weeping and gnashing of teeth."

Look into Dun or Bradstreet.

How many unprofitable servants are cast in outer darkness to begin business over or to take a job under a man who has abundance?

These cold and careful calculators will tell you that many more business enterprises fail than succeed, and as the banker has to loan his depositors' money in safe places, it is plain that the man or company, which gets the money and the needed accommodation is the one "which hath," and accordingly shall have in abundance.

There is nothing unfair or unjust about this purely economic matter.

Any custodian of money must necessarily loan or invest money only in those enterprises which "hath," for out of their abundance will he ever have liquid and proper security as well as continuous earning power in good as well as in bad hours or times.

"Way back in our early history, Washington, Franklin, Jefferson, Hamilton Adams and other courageous men sat in long and tireless conferences, trying to evolve a constitution which should ever be a landmark for our ever changing government's history.

In writing that constitution, the story of the man who went away and left ten talents to one, five to another and one to the slothful one was in their minds.

And they reasoned among themselves that a successful government must have a successful people, for "unto every one that hath shall be given, and he shall have abundance."

And after a man had abundance they reasoned that no man could take it away from him. And so the 14th amendment was given to "him that hath," so that no property could be taken away from him without due and careful process of law.

Right then and there they cast the unprofitable servant into outer darkness because they did not take away from the creditors of this unprofitable servant the right to take his property away from him when he buried his talent—when he did not assert his rights, attend to business, pay his debts, and bond interest and dividends to his investors.

Sometimes one wonders as he looks over so many struggling telephone properties, if the schools to which some telephone men have gone were taught civil government, including the

beauties as well as the benefits of our wonderful constitution.

When our ancestors wrote this guarantee against confiscation into our bill of rights, they meant that the coming telephone man had no further worry about debts, interest and dividends.

All any telephone man needs to do, this very day, is to turn to his copy of our constitution, read the 14th amendment and then look up the 25th chapter of Matthew.

In a flash he will decide to leave the class of unprofitable servants and keep in the commercial sunlight. There shall be no weeping among his stockholders and no gnashing of teeth among his bondholders as they send their certificates and coupons to a protective committee.

Contrary to public notion, no public utility concern has ever yet run a mint or printed its own currency, or had any other mysterious means of support.

The only financial support any public utility gets is what it derives from its customers for service.

The only support a telephone company gets lies in the collection of a published rate for business and residence service, and for the use of the exchange as a toll terminal.

And as the years go by, the telephone man has learned that he started off too cheap.

While it was a condition, not a theory, that led him to start cheap, the fact remains that he did and that this loss was the public's as well as his, and should be fully capitalized or amortized. Because all alike shared in the ignorance and inexperience of a growing business.

Telephone service has not been alone in the too cheap theory.

Telephone materials have always been sold for less money than it cost to merchandise them. How, else, could we point to the long line of dealer and manufacturer failures, or their diversion to other channels?

There have been plenty of operating failures, too; Bell as well as Independent, because telephone men by conditions over which they had no control or sloth, had become unprofitable servants, cast in the outer darkness of bankruptcy. Their creditors gnashed their teeth in helpless rage; while families mourned the loss of a livelihood.

There was some excuse for the dealer or manufacturer, but no excuse exists for a telephone company, in normal surroundings, not having abundance.

Our ancestors did not care what became of the ordinary business man, dealer or manufacturer, he has to shift for himself, but they did brood over the public utility operator and said he was an unprofitable servant if he did not make the public walk up and pay its full obligations.

If the telephone man sticks to his constitutional rights and has the *courage to take* all the grief that goes with the assertion of such rights, he could pay good dividends. He could even have a rainy day fund which only some human beings, all ants and squirrels, seem to realize one should have.

And the telephone man who earns and pays a dividend, who sets aside a rainy day fund, and who keeps a balance in the bank, always will come under the head of he "which hath" and shall have abundance to carry on and serve the public.

Every industry breeds its own diseases.

I don't think that Washington and Franklin, as they discussed the constitution with Hamilton, ever even dreamed of an interstate commerce commission or a state regulatory body, known by various names.

Our ancestors thought that the distressed telephone man of the future, if his customers and municipal authorities disagreed, could go to a nearby court and have his troubles adjudicated at reasonable cost.

But there came a change and it was thought it would be more economical to have an industrial board which could specialize in such cases and become more speedy and efficient in the disposal of such cases.

One thing sure, it has not become more economical because state expenses with according taxes, have doubled and tripled and a rate case has ceased to be a sport within reach of a normal pocket book.

And true to law of action and reaction, some states have given their commissions judicial powers which have caused some commissions to be well and properly named "Courts of Conviction."

But in every aspect of the case no commission rule or law will ever deprive any public utility corporation of its protection against confiscation and ruin—even if the commission believes it is doing the right thing.

Every public utility commissioner alive knows in his own heart that any industry, as a government, must have abundance, and that unless he protects the industry in his charge from losses, it shall be cast in outer darkness and the citizens of the state enveloped in self ruin.

The public utility commissioner is human. No man need apologize for asking him for a rate which will let him live and out of his "abundance" have enough to take care for his increasing business.

No state is stronger than its weakest industrial link. No commissioner alive today can point with any more pride to starved children than he can to state ruined business concerns, sailing under his own state charter.

Some commissions have press agents.

Just why commissions come into the class of prize fighters, movie actors and congressmen, none can say.

But when you read the following, you will wonder why taxes are not higher and there is not more weeping and gnashing of teeth:

> "The commission declares that the advance in utility rates during the war was small as compared with commodity prices.
>
> "As nearly as can be determined the average increase in utility rates was between 35% and 40%.
>
> "Figures compiled by our government show that retail prices at the end of 1920 were 172 as compared to 100 in 1913.
>
> "Assuming no regulation of public utility rates had been in effect and that the public utilities had increased their rates exactly on a parity with the increase in other commodity prices, they would have collected $495,500,000, instead of $388,900,000 actually received.
>
> "Through regulation by commission it may be said that there was saved to the people of the state a sum of $100,000,000, or $30 for every man, woman and child in the state."

Did you ever before read of such a misconception of the duties of a public utility commission?

The commission's real business in this state was to prevent the earnings of the public utilities from exceeding $495,500,000.

What people saved this $100,000,000 and what people were denied this right to a $100,000,000?

Why such unutterable discrimination against the man, woman and child which "hath," in favor of the slothful and unprofitable servant which had not and should according to this old law lose even what he hath. Why a premium on the hook worm?

Either the commission misunderstands the law or such a state is a decidedly poor place for an investor.

What would you think if the governor of your state were to appoint a

group of celebrated burglars, safe-blowers and yeggmen and order them to reduce the $495,500,000 deposits in the state banks, to $388,900,000, and divide the $100,000,000 or so among the people?

No commission, true to the spirit of law and equity, needs to apologize for its existence, any more than the telephone man who appears before it demanding relief.

And the relief should be QUICK relief, instead of a long-dragged-out delay.

When a swimmer cries for help, it is no time to chide him for going in swimming, or to throw him a book of rules which, with practice, might enable him to save his life the next time he gets in trouble.

There is no excuse for a rate case being dragged out a whole year after the testimony is in.

The whole world of telephone men will point with pride to the Public Commission of Missouri which gave a decision in the Kansas City Telephone company's case within three weeks after the testimony was finished.

And it is a safe bet to say that Missouri runs its governmental functions with less taxes than any other state of its wealth.

Independent telephone men may be proud of having had a member of the Missouri commission as its guest last December.

The greatest calamity which confronts a group of telephone men is rapid growth.

The great Pioneer Telephone company of Oklahoma was started by a few boys, really, who started in the territory before the state grew to its present size; before people dreamed how it would grow.

So great was the need of funds that the Bell company got behind these young men and Independent telephony lost one of its greatest members.

With every telephone man is the problem of financing extensions. His only hope is of having an abundance so that he shall be given unto when he goes to the investment banker for help. And that knowledge is graven deep in the heart of every public service commissioner—if he knows what is best for the state which has honored him.

When all is said and done, financing is a local issue.

A New York house took the Keystone Telephone bond issue and Philadelphia bought them. They would not look at them until a New York house approved of them; then they looked good.

A Los Angeles investment banker may underwrite Redlands telephone bonds, but Redlands people will buy them because they did not know how good they were until some strangers told them.

A Chicago banking house may buy Kansas City bonds, but Kansas City people eventually will take them.

Let every telephone man realize that his rich financial field is at his front door, but he must know the psychology of it.

When a telephone man earns and pays fair dividends; earns and saves a rainy day fund, part in cash and part in property; then will the local banker call him up and try to add to his abundance. Or introduce him to some concern which will show the beauties of his successful business to its own owners and users, and earn a commission for nothing but psychological effort.

Moral: A prophet can have honor in his own country.

Solder Squeezed From Tube An Idea That's Growing.

Newark, N. J.—A metal solder that may be squeezed from a tube like tooth paste or shaving cream is making a big hit with telephone men, according to the makers of the product known as "Solderall." The substance is 50 per cent tin and 50 per cent lead, finely pulverized and mixed with non-corrosive flux, ready for instant use. Easy of utilization in difficult places, modest demand for heat, and freedom from necessity of cumbersome soldering accessories, are features the Solderall makers claim are helping to put its solder on the map in good shape.

Legislators' Idea of "Free Speech" Costs Them Phone.

Lima, Ohio—Long distance service from the Allen county court house has been discontinued because of the county's refusal to pay telephone bills of three years' standing.

Curry County, N. Mex., to Have New Telephone Company.

Clovis, N. Mex. — Incorporators headed by W. B. Cramer of Clovis, are organizing the Curry County Rural Telephone Company, with a capital of $35,000.

NEW USE OF FILTER.

Electrical Filter Is Applied to Radio Telephone and Telegraph.

A new development in the use of the electrical filter, invented by Dr. G. A. Campbell of the American Telephone and Telegraph Co.'s staff, was demonstrated recently in New York when simultaneous telephone and telegraph messages were transmitted by radio on the same wave length. The demonstration was conducted by Dr. Frank B. Jewett, of the Western Electric Co., before a meeting of the Telephone Society held in Engineering Societies building. The filter, developed by Dr. Campbell several years ago, has been applied extensively in the systems of telephony and telegraphy where a number of messages are carried simultaneously over the same wire by means of carrier currents but the present demonstration is the first public exhibition of its use for separating telephone and telegraph currents. The filter differs from the usual tuned circuit of inductance and capacity used in radio. The simple circuit acts as a filter at a single frequency while Dr. Campbell's filter acts to separate a band of frequencies. In ordinary conversation over a telephone line it is necessary to transmit all frequencies from about 200 to 2000 cycles per second, and other frequencies may be suppressed. The electrical filter may be designed to pass all current of these frequencies with very little reduction in amplitude but will practically prevent passage of all frequencies not in this range. By proper proportioning of the elements, the filter may be made to pass a band of frequencies of any desired range. The report of the demonstration conducted in New York states that two specially constructed radio sets were employed and telephone and telegraph messages were dispatched at the same time on the same wave length. The messages were received and detected by a single vacuum tube, after which the telephone and telegraph frequencies were separated.

The development of the filter seems to offer a promising field of advancement in the use of simultaneous radio telephony and telegraphy and the consequent reduction in interference due to the smaller number of wave lengths necessary. It also gives promise of developing a method of relief from existing interference conditions in the radio field which are becoming particularly severe with the development and extensive use of the radio telephone.

Weld Kansas City Systems

Complete Unification of Bell and Independent Systems Effected By the Gary Interests, Jan., 14- Plan Originally Adopted, September 1919, Finally Consummated - Many Problems Met and Solved

By Herbert Graffis

Kansas City, Mo.—The welding together of the two telephone systems in Kansas City now is an accomplished fact, complete unification being effected at 12:45 p. m. January 14, 1922. The culmination of this immense project opens up interconnection of service to 105,000 stations, which is the combined number of stations of the two old systems. Permission was given through ordinances in both Kansas City, Mo., and Kansas City, Kans., for a third company, the Kansas City Telephone Co., to consolidate the two then existing systems, the Kansas City Home Telephone Co. and the Southwestern Bell Telephone Co., it being stipulated, however, that complete unified service should be given not later than thirty months after August 1, 1919, therefore making it necessary that the two companies be consolidated by March 1, 1922. This agreement for merging the two systems was later confirmed by the Public Service Commission of Missouri and the Public Utilites Commission of Kansas. The overcoming of the many intricate and difficult problems of unification was accomplished by the unfailing loyalty and untiring efforts of the combined organization of the two old companies. The organization is justly proud in realizing its ultimate aim of completing the job ahead of schedule and of giving to Kansas City a unified service with a minimum disturbance to subscribers. During the entire unification period progress was delayed due to slow delivery of materials. This necessarily delayed the completion of the unification some months.

Change Plans to Meet Conditions.

The original plan, which was set up September 20th, 1919, for executive approval, was changed, June 9, 1920, due to the fact that the situation in obtaining operators was so acute that it was thought necessary to put forth all effort possible to complete the installation of a 10,000 line Automatic (panel type) unit which was being in-

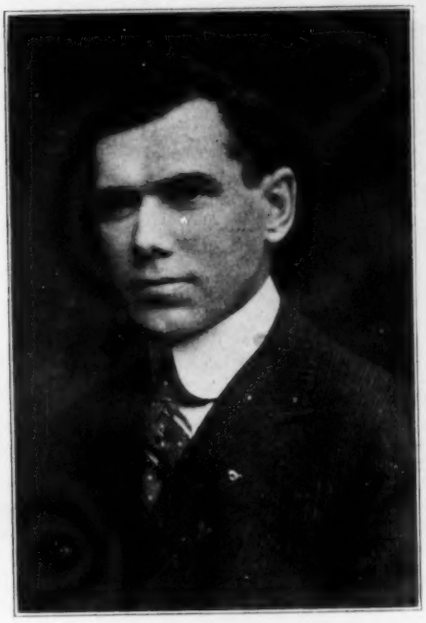
Kansas City Telephone Building.

stalled at that time, in order to relieve sufficient operators to meet the manual operating requirements. It was later found impossible to complete the Automatic unit in time to take advantage of labor conditions and as the operating situation had eased up the plan was again modified so that the unification would be made ahead of the cutting of the Automatic equipment into service. The original plan contemplated the complete unification of two small satellite exchange districts, then the changing of a large number of central office exchange names in the greater Kansas City area, the consolidating of all private branch exchange boards, the supplying of an adequate number of trunk groups and the unifying of all offices in the greater Kansas City area at one time, leaving in all duplicate telephones. It early became apparent, however, that this was not a workable plan as it meant building up a large special force to handle the unification, the regular force being engaged in operating the property. The original plan then was modified so that the two old systems could be continued in operation separately. A unified or merged system to which individual existing offices of both systems could be added, one at a time, was created. In the working out of this plan two directories were maintained (one for each system) until all offices had been connected to the unified system, when a unified directory was issued and the separate directories discontinued.

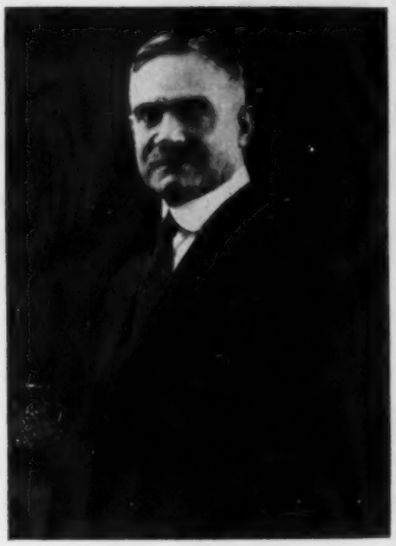
Unified Service Started in September, 1920.

The first exchange to be given unified service was Jackson on September 20, 1920. When this exchange was unified, it was possible for the subscribers in this exchange to have complete unified service with all exchanges in greater Kansas City; and vice versa all exchanges in greater Kansas City had unified service with this exchange. The last exchanges cut into service and thereby giving complete unified service for the entire system were Harrison, Main and Delaware-Victor, these being unified at 12:45 P. M. January 14, 1922. The greater Kansas City exchange area is composed of territory lying in and adjacent to Kansas City and Rosedale, Kans., and Kansas City and Independence, Mo., comprising about 370 square miles and having a population of approximately one-half million. Before the consolidation became effective, there were two separate systems operating with exchanges in both Kansas City, Missouri, Kansas City, Kansas, and their environs, connected by a net work of trunks, giving free service between all exchanges on their respective systems. In August 1919, there was a total of approximately 50,000 stations on each sys-

J. G. Crane, Vice Pres. and Gen. Mgr., Kansas City.



H. L. Harris, Vice Pres., Kansas City Telephone Company.



H. W. Ritterhoff, General Commercial Supt., Kansas City.

tem, served out of the following central offices:

Kansas City Home Telephone Co: (Missouri) Main, Delaware, South, East, Linwood, Jackson, Independence; (Kansas) West, Vance.

Southwestern Bell Telephone Co.: (Missouri) Main, East, South, Wabash, Hiland, Leeds, Fairmount-Brookside, Independence; (Kansas) West, Rosedale, Argentine, Merriam, Bethel.

Two Chief Problems of Unification.

The organization had two distinct problems to handle during the period of unification: one, the unification of the two systems; the other, the introduction of automatic telephone service into the existing network. It was necessary to change a large number of central office names for the following reasons: first, a similarity of exchange names on each system; second, the introduction of automatic service made it necessary for dialing purposes that there be no conflict in the first two letters of an exchange name and that exchanges serving party lines be given an additional exchange prefix. It was also necessary, in connection with the introduction of machine switching service, to change all subscriber's numbers above 9 and below 1,000 by prefixing one or two ciphers in order that all numbers be of four digits. In September, 1919, after a comprehensive study had been made, in which thousands of test calls were passed in order to select names on which the minimum amount of errors would be encountered on order-wire work, changes were made and new names assigned to central offices as follows, the total number of exchange prefixes after this arrangement was made being forty-two:

Original Office Name	Present Name	Party Line
Main-Bell	Main	
Main-Home	Harrison	
East-Bell	Clifton	Melrose
East-Home	Benton	
West-Bell	Fairfax	Fifield
West-Home	Drexel	
South-Bell	Westport	Valentine
South-Home	Hyde Park	
Grand-Bell	Grand	Baltimore
Wabash-Bell	Wabash	Elmridge
Hiland-Bell	Hiland	Atwater
Rosedale-Bell	Rosedale	Winfield

C. M. Martsolf, General Traffic Supt., Kansas City.

W. N. Faust, General Plant Supt., Kansas City.

H. E. Gwillim, Traffic Engineer, Kansas City.

Argentine–Bell	Argentine ...	Humboldt
Leeds–Bell	Leeds	Republic
Brookside–Bell.....	Riverside	Sycamore
Linwood–Home	Linwood	
Jackson–Home	Jackson	Murdock
Delaware–Home	Delaware	
	Victor*	
Independence–Bell	Independence	
North Kans. City	Norelay	Randolph
Overl. Pk.–Home** ...	Overland	P–Milburn
Hickm'n Mills–Home**	Hickman Mills	Andover
Shawnee–Home**	Shawnee	Douglas
Merriam–Bell**	Merriam	
Bethel**	Bethel	Vance
Vance**	.....	

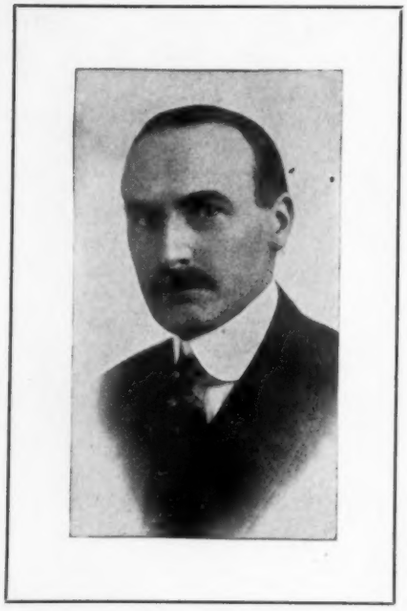
*New Exchange established.
**Suburban Exchanges.

Changes in Methods and Practices.

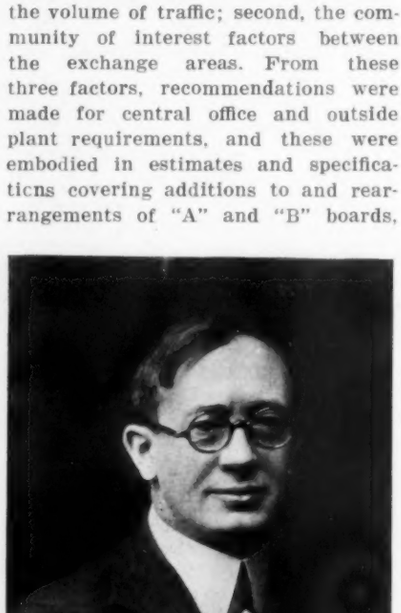
These changes were made gradually, over a number of issues of the directory, in order to avoid the confusion of having all of the changes made at one time. During the period of the unification the completion of the new Telephone Building made it advisable that the General Manager's, Accounting, Commercial, Traffic and Plant Departments be moved into the new building. Previous to this move the two organizations had retained their identity and were housed in separate buildings. At this time the organizations were brought together and functioned as one, but retained the identity of the various methods and practices of the two old organizations. It was necessary that methods and practices be worked out very slowly and, at the time of the complete unification, the Commercial, Traffic and Accounting practices were uniform for the system. The Plant Department has of a necessity been required, due to the different types of outside plant and central office equipment, to retain in a large measure the practices of the old systems. These differences in practices are being gradually worked out and will at some future date be made uniform. During the entire period the public was carried along by telling them what was being done in order to complete the unification, through ads in the newspapers, lectures before civic clubs and inserts in the subscribers' monthly bills. All of the central office buildings with the exception of the old Main exchange will be retained in service; this building will be vacated at the time the Main exchange is cut over to the Automatic unit.

Three Problems of the Management.

There were three distinct problems which confronted the management: first, converting the two organizations into one; second, laying out of the plan; third, carrying out of the plan. It was necessary to make a number of commercial and engineering studies and on the results of these studies the plan finally adopted was based. The first of these studies was one by the Commercial Engineers, of duplicate stations that would be removed and a forecast of the growth for each exchange area. Next, bottomed on this study, Traffic Engineering studies were made to determine, first: the increased calling rate and the volume of traffic; second, the community of interest factors between the exchange areas. From these three factors, recommendations were made for central office and outside plant requirements, and these were embodied in estimates and specifications covering additions to and rearrangements of "A" and "B" boards, outside trunk wire plant, wire distributing systems and building.



W. C. Polk, Consulting Engineer, Kansas City.



C. J. Larsen, Building and Equipment Engineer, Kansas City.

Some Work for the Traffic Engineers.

It is interesting, in passing, to note some of the many difficulties that confronted the Traffic Engineers. Due to the fact that practically no community of interest existed between subscribers of the two systems previous to the unification for the reason that the subscribers in their choice of the two systems already had indicated the system with which their interests were associated, it was necessary to estimate the community of interest between subscribers of the two systems, both initial and ultimate and the rapidity with which this community of interest would develop. It was realized that the establishment of means of communication between subscribers of the two systems would not immediately develop a high community of interest but that as duplicates were removed and as the overlapping areas were straightened out by cutting over subscribers' lines from one system to the other, community of interest would gradually develop to a normal point. The inter-office trunks were then determined based on this community of interest starting off with a small number of trunks with a provision made for gradually increasing the size and number of trunk groups as the traffic developed. The necessity for careful calculation to determine within a reasonable limit the community of interest factors is apparent when it is considered that should the calculation prove too low there would be insufficient facilities between offices with resultant bad service. If too high, unnecessary expenditures would be made for surplus equipment. In determining the number of trunks required between exchanges, both for the initial and ultimate, considerable attention was given to possible variation in trunk holding time. In straightening out certain overlapping exchange areas, it was found necessary to cut a number of lines from one exchange to another, and in some instances a majority of these lines in the overlapping area were business lines. The cutting of these business lines out of one exchange into another, in a number of cases, materially changed the ratio of total business to total residence lines in the affected exchanges and consequently affected the holding time on both local and trunked traffic. It was necessary to estimate, in all such cases, the exact effect this change in holding time would have on the va-

(Continued on page 40.)

The Telephone Engineer

Analysis of His Work and His Place in the Organization of a Telephone Company—Survey of His Duties in the Three Departments: Commerce, Traffic and Plant

By R. V. Achatz

Editor's Note—R. V. Achatz who takes a place on the editorial staff of TELEPHONE ENGINEER beginning with this issue, entered the telephone business at the age of 14. His first experience in this industry was obtained at Algona, Ia., in 1900. During the period from 1900 to 1908, when not in school, he was employed by various companies in northern Iowa, particularly at Algona and at Spencer and served in almost every possible capacity. At various times he was a messenger boy, operator, book-keeper, collector, groundman, troubleman, lineman and line foreman. His technical training was obtained at Iowa State College at Ames where he spent two years and at Purdue University where he specialized in Telephone Engineering and graduated in 1908. After graduation, Mr. Achatz entered the employ of the Chicago Telephone Co. and, after a year at Douglas office as Tester, was made Wire Chief of the South Chicago Division. He left this position for a year as Assistant Engineer with the Arnold Co. on appraisal work and then returned to the Central Engineering Department of the Central Group of Bell Telephone companies where he had charge of central office and substation appraisal under the Appraisal Engineer. In September, 1913, he returned to Purdue to take the position as Instructor in Telephone Engineering where he has remained up to the present time, having been advanced successively to Assistant and Associate Professor. During 1918, he was Senior Civilian Instructor in charge of the instruction work of the U. S. Signal Corps School for Radio Electricians at Purdue. In addition to his work of instruction, Mr. Achatz has been very active in telephone matters in Indiana, taking part in District and State Conventions and conducting Short Courses of Instruction for telephone men.

Engineering has been defined as "the art of directing the great sources of power in nature for the use and convenience of man". This definition is not only a statement of the scope of engineering but also differentiates it from the other learned professions; the ministry, which deals with man in his relation to the Creator; the law, which deals with man in his relation to the social organization in which he lives; and medicine, which deals with man in his relation to his own physical well-being. Engineering deals with man in his relation to the sources of power in nature, whether the source be in the energy of man or of inanimate objects. Another definition of engineering is "the determination of the most economical method of achieving a desired result". This definition is complementary to the other, as the former defines the scope of the engineer's work while the latter defines his method of procedure. It implies a selection from alternative methods and a determination based, not on guess or conjecture, but on information, upon which a well reasoned judgment may be formed. The engineer's method of procedure is to gather data, to formulate plans and to select from among the possible plans

R. V. Achatz.

that which is best suited to the project under consideration. These preliminary ideas are set down as a preface to what follows in a brief analysis of the place of the engineer in the telephone industry.

Divisions of Telephone Work.

The most common form of organization to carry on the business of the telephone company is a functional one in which the work is divided between three departments,

1. Commercial
2. Traffic
3. Plant

As the name suggests, the commercial department handles the commercial and public relations of the company. Its work includes publicity and advertising, securing contracts, making collections and looking after the accounting. With it are associated thoes who handle the legal relations and the relations with the public and with other companies; also, those whose duty it is to prepare and present cases involving rates and service before public service commissions and other regulatory bodies.

The traffic department is the operating department of the telephone organization. To perform this function it has the duty of building up a force of operators and of determining the kind and amount of switching equipment and the number of lines necessary to furnish service to telephone users connected to the system.

The plant department deals with the physical equipment of the tele-

phone business. It is the department that constructs and maintains the telephone plant. In this discussion the manufacturing branch also will be included under the plant department, since it is primarily engaged in designing and manufacturing plant equipment.

Each of these three departments of a telephone company has a certain amount of work of an engineering nature and telephone engineers may be designated, accordingly, as commercial engineers, traffic engineers and plant engineers, although the work of each may overlap to a certain extent.

The Commercial Engineer.

In few lines of engineering are there closer relations between the engineering and the commercial sides of the work than in the telephone field. The engineer who designs the structural steel work of a modern office building is not concerned with the rentals to be charged for floor space after the building is completed. The engineer who designs a telephone distribution plant, on the other hand, finds that the character and amount of plant is profoundly influenced by the rentals to be charged and the ability of the prospective users to pay for service. The two things are interdependent and a liason must be maintained between the plant and commercial departments so that each may be provided with the necessary information. The liason office in this case is the commercial engineer. The commercial department is held responsible for the preparation of estimates of station growth so that the necessary amount of plant may be provided in advance. Statistical methods may be satisfactory for short periods but estimates covering longer periods and involving not only the number but the distribution of stations over the area served also are necessary. At such times extensive engineering studies of present and future distribution of telephone stations are made and a fundamental plan for providing the lines and central offices in the most economical way is drawn up. The making of development studies and fundamental plans is one of the important types of work of the commercial engineer. Other types of commercial engineering are the preparation of appraisals in cases involving purchase or sale of plant, rate revision, financing, taxes, insurance, etc., and the determination of the life, salvage and rates of depreciation of various classes of plant and equipment.

The Traffic Engineer.

Engineering problems exist in the traffic department as well as in the commercial and plant departments, and their solution is the work of the traffic engineer. The traffic engineer has aptly been described as "the production engineer of the telephone system". The fundamental problems with which the traffic engineer deals have been well presented in a splendid paper by F. P. Valentine in the Transactions of the American Institute of Electrical Engineers (1911), and no better statement of these problems can be made than to quote the five principal matters for engineering study in connection with telephone traffic, as given in this paper. These five principal matters are,

1. Quality of Service
2. Efficiency of Labor
3. Efficiency of Operating Methods
4. Production Efficiency of Central Office Equipment
5. Production Efficiency of Toll and Trunk Circuits.

Engineering methods applied to these matters will result in improvement in the quality of service and more economical operation of the system.

The Plant Engineer.

The number of engineers required for plant work exceeds by far the number in the other departments, as the entire telephone plant is an engineering structure and engineers are employed in every division of its construction and maintenance. Plant engineers are given a large variety of titles, depending greatly upon the subdivision of the work in the organizations to which they are attached. Outside plant engineers draw the detailed plans of the distribution system to conform to the fundamental plan, write engineering specifications covering the material that is to go into the plant and specifications to guide the construction foreman in the erection of the material. They inspect the work while it is in process and after completion to see that the specifications have been complied with. Toll line engineers perform the same kind of work for the toll system. Transmission engineers compute the transmission equivalents of various types of circuits, fix transmission equivalents that must be adhered to in various areas and between various centers and test equipment and circuits to see that satisfactory transmission is obtained. Building engineers consult with architects to see that the proper arrangements are provided in new buildings for the equipment that is to be installed and plan changes and additions to existing buildings. Equipment engineers develop circuits, design apparatus and plan and write specifications covering the installation of central office and other equipment. Protection engineers develop methods of protection against lightning and crosses with high tension lines and for the mitigation of electrolysis and inductive interference. Maintenance engineers study the methods and routines of maintaining the plant in a satisfactory operating condition. This list might be extended to include other divisions but those quoted serve to show the varied nature of the work of the engineer in the telephone plant.

Who Is the Engineer?

The division of telephone engineers into commercial, traffic and plant engineers in this discussion does not mean that each of the three main departments of the telephone organization has its own engineering department. It is true that in some organizations engineers are attached to each department but there are other organizations in which there is a separate engineering department under the direction of a Chief Engineer who reports directly to the General Manager, and under whom are centralized all of the engineering activities. Cases where the two forms of organization are combined are also found. With companies of smaller size the functional type of organization is usually less highly developed and the engineer of the company, with a few assistants, may perform all types of engineering work. In still smaller organizations, a single individual may comprise the entire engineering staff or the engineering work may be done by other members of the organization, such as the general manager or the plant superintendent, with the assistance of consulting engineers when special problems are to be met.

Likewise, it must not be supposed that all of the divisions of engineering enumerated above exist in any one organization. Often, two or more are combined under the supervision of one engineer. In other cases, as special problems develop, new divisions are created which may become permanent or may be absorbed by other divisions as the solution of the problem is completed or the work becomes part of the routine of the organization. The engineering organization must be flexible enough that it can be adjusted as conditions change so that the various problems may be met as they arise.

The Economic Side.

In few other industries has the economic side of engineering been given the attention that it has received in the telephone field. In general, the best engineered plant is the one that will furnish a given grade of service for the least cost, in the long run. Present conditions in the industry require the greatest economy in the construction and operation of telephone plants and telephone engineers are engaged continuously in making cost studies of various types of construction and kinds of equipment. These cost studies cover not only first cost but the fixed charges—interest, depreciation, etc., which depend upon first cost—and the cost of operation and maintenance. It is true that the selection can not always be based upon cost alone but the costs must be known before the various non-cost factors can be balanced against them. This selection requires wise judgment; in fact, economical and profitable operation in the telephone industry rests more and more each year upon the good judgment of the engineer.

TELEPHONE POLE MEN.

Twenty-Sixth Annual Meeting of the Northern White Cedar Association at Minneapolis.

The twenty-sixth annual meeting of the Northern White Cedar Association convened at Dyckman Hotel, Minneapolis, Minn., January 31st, 1922. President Finch being unable to attend on account of illness in his family, Vice-President W. B. Thomas presided. Firms were represented as follows:

American Cedar Co., H. S. Gilkey

Bay De Noquet Co., Mr. Good

Bell Lumber Co., M. J. Bell and W. C Meader

Canadian Cedar & Lumber Co., W. W. Scoville

Cedar River Lumber Co., L. C. Paulson and Mr. Oleson

Cloquet Tie & Post Co., F. W. Wilhelmi and H. M. Dixon

Coolidge-Schussler Co., M. H. Schussler

Crawford Cedar Co., J. R. Roper

Curry & Whyte Co, E. N. Whyte

Learned Lumber Co., C. E Learned

MacGillis & Gibbs Co., J. E. Gerich and L. C. Chapman

Minnesota Cedar & Logging Co., J. C. O'Connell

National Pole Co., A. D. McIntyre and W. L. Lafean

Naugle Pole & Tie Co., A. T. Naugle and Joe Naugle

Page & Hill Co., L. A. Page and L. L. Hill

T. M. Partridge Lumber Co., T. M. Partridge and H. F. Partridge

Pendleton & Gilkey, H. S. Gilkey

I. Seery, I. Seery

C. P. Tinkham, C. P. Tinkham

Turtle Lake Lumber Co., W. E. Vogelsang

Valentine-Clark Co., E. L. Clark and G. G. Willson

Virginia & Rainy Lake Co., A. K. Berger

White Marble Lime Co., W. B. Thomas

Treasurer Partridge reported the association's finances in a flourishing condition.

Secretary Boucher, in his report, said that "like many a good business, the cedar industry is ailing, and being affected by loss of membership at a time when closer co-operation is most needed. When one is sick is no time to quit paying life insurance or forego the services of a doctor. There was expended in the association's interests, during 1921, a greater sum than ever before, which indicates that it tried to show as much intelligence as a hen and continued to scratch even if the worms were scarce.

L. A. Page reported for the Pole Advertising Committee and outlined the work of the year. On motion of A. T. Naugle an appropriation of $7,000 was made to be expended at the discretion of the committee, and apportioned according to shipments, as in the past.

L. L. Hill, for the Post Advertising Committee, told of their work during the year. The committee had nothing to offer as a recommendation for the future and a discussion convinced all there was little sentiment in favor of expenditures for post advertising.

T. M. Partridge, for the Legislation Committee, related the workings of a new law which serves to create a standard rate of $5.79 as against insurance previously obtainable at about $4.00. This law makes no prohibition against dividends by mutual companies, and will, so far as cedar operators are concerned, force them to insure with mutual companies. Mr. Partridge was instructed to file a resolution against federal legislation that would change the present system of imposing duties.

As representative of the Association at the recent meeting of the National Association of Railroad Tie Producers, at Chicago, Mr. Schussler made an interesting report.

E. N. Whyte, of Duluth, in reporting for the Pulpwood Committee, referred to earlier meetings during October which convinced the producers of the futility of cutting pulpwood under existing conditions. It was his view that production would approximate but 20 per cent of last year, and approximately 25 per cent of the normal production. What pulpwood is being taken, is small lots cut by homesteaders and farmers. Scandinavian countries are putting their wood pulp into New York cheaper than it can be ground in the vicinity of Duluth. Low water in Wisconsin during September and October, as well as strikes, also hampered the production of pulp. Mr. Roper reported that in the vicinity of Marinette and Menominee, the pulpwood was going begging, little being produced except by farmers. Mr. Thomas reported that in the Upper Peninsula of Michigan, because of strikes and lack of water, mills found difficulty in meeting their pulp requirements, necessitating even, in some instances, borrowing wood from competitors. Scandinavian and Finland pulp, he said, was not proving just what was expected by the buyers.

The election of officers resulted as follows:

W. B. Thomas, Manistique, Mich., President.

M. H. Schussler, Minneapolis, Minn., Vice-President.

H. F. Partridge, Minneapolis, Minn., Treasurer.

W. L. Lafean was continued as Director for two years; Benj. Finch, ex-President, was elected a Director for one year, and F. W. Wilhelmi, Cloquet, Minn., also was chosen a Director. After the meeting adjourned, the Directors reappointed N. E. Boucher Secretary.

Nebraska Annual Convention at Lincoln Feb. 23 and 24.

The Annual Convention of the Nebraska Telephone Association will be held at the Lincoln Hotel, Lincoln, Neb., on February 23 and 24. The program has not yet been announced but many important matters are to be considered. Bruce Brown is President of the association and R. E. Mattison is Secretary.

Carnival Spirit Kills Service of 23 New Orleans Cables.

New Orleans, La.—When they get playful in New Orleans, shooting at telephone cables seems to be one of the most popular ways of celebrating. During a recent holiday 23 telephone cables were put out of service by bullet holes.

A New Vacuum Arrester Idea

Another Contribution to Protection of Delicate and Expensive Telephone Equipment Comes in a Small, Heavy Glass Vacuum Capsule—Notes on Design

Apparatus used in telephone, telegraph or signal service is of expensive and very delicate structure. When it is remembered that apparatus of this kind is naturally subjected to its own high voltages, atmospheric electricity and high potential power lines, it will be readily conceded that any improvement which can be made for protecting such apparatus is worthy of closest consideration, even though the first cost of installation may be relatively high.

Ordinary fuse arresters have always been considered fundamentally necessary. In the telephone field it has been found that one of the most destructive and difficult agencies to trap has been termed "sneak currents." Air-gap lightning arresters have always been deemed essential and many types have been on the market for a number of years which have been more or less successful for the purpose for which they are designed. In all of these designs, though they may differ materially in details, the plan is to provide a free path to ground for the foreign current while preventing the escape of the working current. They are wired into the circuit in shunt to the protecting lines with a gap of some kind to ground which will not permit of a breaking down of the working voltage but which will readily give way to one of a higher voltage as soon as it is impressed upon the circuit.

The old type of air-gap lightning arrester consists of electrodes of metal, carbon, carborundum or other conducting material separated by a small air space usually from .005 to .0055 inches. This separation of the electrodes is sufficient to prevent the escape of current when not less than 350 volt, but breaks down above that voltage and establishes an arc to ground as long as the foreign voltage is impressed upon the circuit. This minute distance between electrodes makes the problem of adjustment a very difficult one since it is exposed always to the atmosphere, being therefore, subject

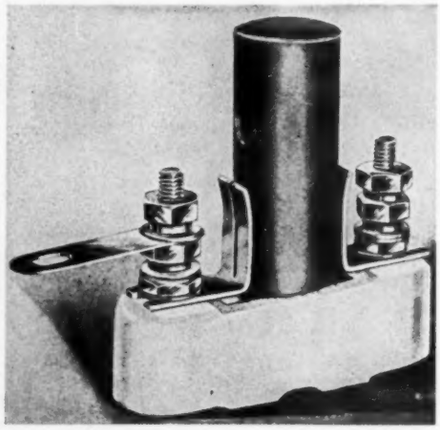


Fig. 1; How Vacuum Capsule is Held.

to dust, moisture, changes of temperature and insects, all tending to impair its reliability and bringing about heavy maintenance expense. When such an arrester does operate after heavy discharges, it will, because of its construction, pit or short circuit to ground, thus making it necessary to inspect, clean and adjust it after heavy storms or any other time it may be suspected of functioning.

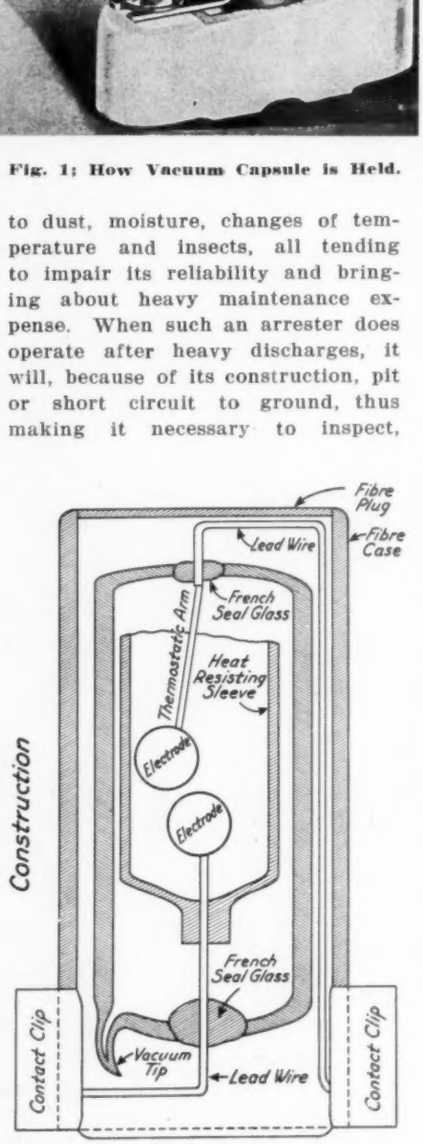


Fig. 2; Construction of Arrester Element.

Vacuum Type Enters Field.

On account of all of these difficulties with the ordinary air-gap lightning arrester, the vacuum type of arrester has been designed, and since, during the past five years material progress has been brought about in the design and manufacture of vacuum and gas filled electric lamps, it is indeed a fortunate condition that all of this experience in in the manufacture of these high grade products can be taken advantage of in the design of a vacuum type of lightning arrester. Considerable advantage can also be taken of the experience which has been obtained in the manufacture of telephone lamp repeaters which are now in service on long distance lines. It has for a long time been known that a partial vacuum is a much better conductor of electricity than air and if the air gap were to be enclosed in a container with the proper degree of vacuum a very delicate adjustment of distances between electrodes would not be necessary. The spacing between the electrodes can be made much greater and the time of operation made instantaneous. In the manufacture of the air-gap vacuum type of lightning arrester a considerable amount of experimenting has been done in determining the time lag of these arresters. By time lag is meant the interval of time required for the foreign current to spill across the gap and escape to ground, after the excessive voltage is impressed upon the circuit. This time lag of the air-gap vacuum type of arrester is a minimum for a particular degree of vacuum and is of vital importance since it may be great enough to permit the destruction of the instrument it is supposed to protect even though the foreign current may break down the resistance of the gap and escape to earth. Provided the delay in escaping to earth is appreciable it will

be clear the foreign current will enter the instrument in a building before the gap to ground functions. It has been found that there is one limit degree of vacuum which operates instantaneously and invariably protects the system. Actual field tests using 200 amperes to ground in momentary flashes have demonstrated a vacuum type arrester will not be affected in the least. Oscillograph tests have also been made which show that these arresters operate with greater speed than either the carbon or copper block air-gap device. See figures three and four.

Vacuum Design Considered.

In considering the manufacture of a vacuum type of air-gap arrester it will be self evident that if such an arrester is assembled in a glass vessel alone, many accidents can occur which would impair the desired vacuum. It would also be plain that an arrester with an impaired vacuum will at all times give a false idea of security. Such an arrester when filled with air would not break down at thousands of volts on account of the great distance separating the electrodes, although it may have operated perfectly at 250 volts with the proper vacuum. Carbon electrodes in such an arrester are also liable to give off gases, thus lowering the vacuum. Arresters of this kind also become hot after operating and re-absorb the gas to a greater degree than originally, thus increasing the vacuum. In either case the breakdown point has been raised and the next time it is required to operate it may fail since the voltage may not be sufficient. From this it will be seen the small metallic electrodes are to be preferred since they contain very little gas and the vacuum is therefore not subject to appreciable change on this account. The vacuum of the air-gap arrester may be further impaired by slow leakage around the leading in wires. This difficulty can be immediately overcome by the use of a composition leading in wire, having the same co-efficient of expansion as the glass, thus preventing strains and eventual cracking of the shields. These wires should also be large enough to carry easily any excess current without undue heating and should make a tight seal with the glass. Strains in the glass container or capsule can be avoided by eliminating the shoulders on similar parts. This is a matter of design. See figure two. Unless this is done it will be found when the arrester functions that great heat is generated at the electrode and unless this excessive heat is prevented from reaching the glass or the capsule contained in the glass a crack is bound to occur with the consequent loss of vacuum. All of these enumerated difficulties have been overcome by making use of the experience gained in the manufacture of electric light bulbs and heat resistant glass such as Pyrex has been found for surrounding the electrodes between the latter and the capsule. Arresters with a sleeve of this kind have been operated over 700 times on test and have been found to be as effective as at the start of the test. In making these comparative tests it was noted that mica or other similar materials last only a few discharges.

Fire Hazards.

Any type of arrester will take care of momentary discharges such as an inductive surge or static charge on the line without becoming a fire hazard and in the arrester with a permanent air gap will start an arc to ground and may maintain it if it is crossed with a trolley wire or electric power feeder. A cross of this kind is not likely to be momentary except in the case of a swing wire cross. In an arc of this kind, especially when obtained in the confined space of an arrester, even though the current is of a few amperes, it is sure to become a fire hazard in a very few seconds and will also destroy the lightning arrester. To overcome this the electrodes should approach each other and as soon as they get hot short circuit the arc, extinguishing it immediately thus furnishing a free and unobstructed path to the ground for the foreign current. This may be accomplished by mounting one electrode rigidly and the other on the arm of a thermostatic metal which will warp when heated, causing the electrodes to come in contact. Obviously the thermostatic electrodes will separate again when they become cool, thus automatically restoring the arrester to service conditions, without maintenance or inspection. There are many thermostatic metals, the most preferable being nickle and brass in strips fastened together.

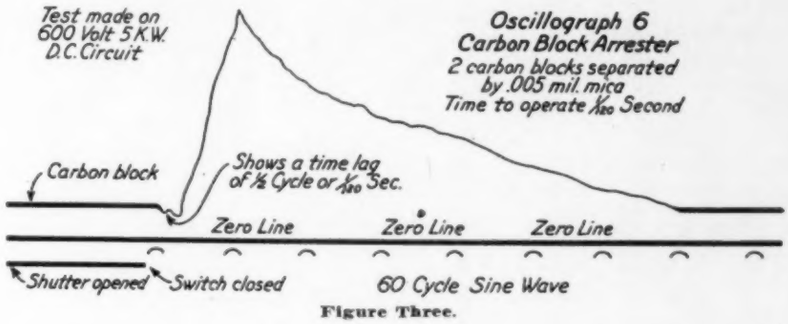


Figure Three.

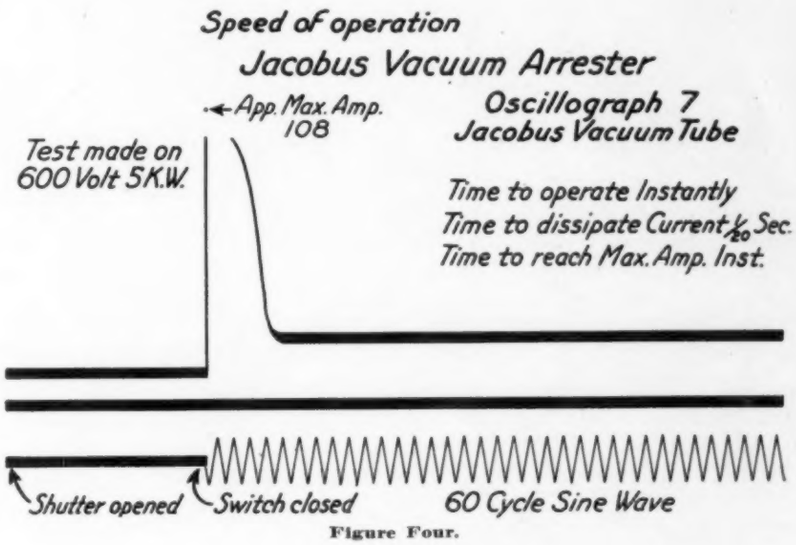


Figure Four.

Since the brass expands or contracts more than the nickle the compound metal is warped one way or another in a manner well understood. The reliability of such a metal has been found for use in the balance wheel of watches and other apparatus where a compensation for temperature changes is desired. It is true that when such an arrester short circuits an excessive amount of current is liable to pass through it, possibly for hours, before the cross is removed. It is therefore necessary to protect such an arrester with a small fuse which will blow and open the circuit. By increasing the proportions of such an arrester a larger fuse may be used which will not blow unless every large current passes and such an arrester will therefore save maintenance costs since the renewal of fuses will not be required except in a few extraordinary cases. See Figure five. It is, of course, not permissible to use the short circuiting arrester in railroad signal work. The vacuum arrester for signal work must have set on immovable electrodes.

In the manufacture of vacuum gap lightning arresters it has been the custom to make them like a cartridge fuse; others have been designed using electric light bulbs.

To the first type, objections might be made in that it is subject to strains due to the clips being slightly out of line making poor contacts or straining the arrester. The ordinary glass lamp type is objectionable in that it has a porcelain base similar to a cutout permanently attached to it and to replace such an air-gap arrester wires must be disconnected and re-connected. It is also made of thin glass exposed on all sides and has a glass tip, all of which makes it a very delicate contrivance. An improvement on both of these types, say the makers of a new arrester, is found in a small, heavy glass capsule, non-rigidly confined in a stout protective tube of fibre sealed completely, having a small window in order that observations of the vacuum may be made. All strains are eliminated and replacements easily made by having all contacts on one end only. For purposes of testing the vacuum a small spark coil may be connected and the characteristic glow observed through the window. Provided the vacuum is too high or too low colored tints are observed different from that of the proper vacuum. If no vacuum exists or if the vacuum were to be too high no glow at all would be observed.

YORK STATERS MEET.

First Convention of New York Up-State Association Big Success.

Albany, N. Y.—After nine crowded months of life the Up-state Telephone Asociation of New York held its first annual convention here January 18–19. About two hundred telephone and supply men were present at the first affair and all voted the infant association had made a successful plunge into existence.

Mayor Hackett of Albany, and the secretary of the local Chamber of Commerce, Roy S. Smith, held out the municipal glad hand to the visitors, their greetings being acknowledged by President George R. Fuller of the association.

A review of the association's activities during its brief and busy life was made by the organization's secretary and general manager, J. F. Ihmsen. Following Mr. Ihmsen's report, F. B. MacKinnon, president of the United States Independent Telephone Association told of the progress of the national body. Mr. MacKinnon stressed the fact that the size of most of the Up-state association's member companies permitted an intimate contact between the company executives and its subscribers which was a valuable factor in building and maintaining good-will and profits. He asserted the Independents had considerable edge on the larger Bell companies because of this intimacy. The importance of telephone company executives "selling" the company and its service to the utility's own employes was brought out forcibly by Mr. MacKinnon.

Tax matters in New York were as mysterious as a Hollywood movie murder according to Mr. More of Pennsylvania, whose telephone interests in New York state, and whose frequent visits to the Empire domain had given him a closeup of the peculiar phases of his neighboring state's tax system. He suggested attention to simplification of taxation as one of the convention's most important duties.

Lyle Olsen of the American Appraisal Company talked briefly on valuation, depreciation and kindred subjects, from the viewpoint of the appraiser.

W. S. Vivian, the Automatic Electric Company's able campaigner, stirred the convention with his remarks on the achievements of association work. His graphic statistics on the extent and importance of the telephone business were most impressive. He told of the value of holding district meetings of telephone men in conjunction with local chambers of commerce, and of the value of district operators' schools.

Mr. Ihmsen's intensive and successful work in putting the association on the map in such a short time was the subject of a glowing tribute paid by President Fuller.

Treasurer H. P. McDonough's report was read and approved.

The Wednesday session's adjournment was followed by a visit to the exhibits, which were pronounced about the best a state association has seen for many moons.

E. B. Rogers, Telephone Engineer of the Public Service Commission spoke on Practical Telephone Matters and Co-operation. He urged for close teamwork between the utilities and the commission and for a greater development of the community's goodwill. J. J. Merrill of the New York Tax Commission, spoke in place of Senator F. M. Davenport, on the unification of telephone companies' taxes in New York. He favored a tax on gross receipts.

H. E. Bradley, president of the Pennsylvania State Telephone and Traffic Association congratulated the New York association upon location of their headquarters in the state's capital where close contact with governmental authorities could be kept. He told how the Pennsylvania association "snapped into it" every time a request for help came from a member company.

"The Dial of Destiny" Automatic's cinema "drammer" was shown and won enthusiastic endorsement.

Upon the recommendation of the nominating committee, the following names were placed in nomination for directors: J. F. Boylan, Rochester, N. Y.; B. H. Brooks, Platsburgh, N. Y.; F. D. Fancher, Middletown, N. Y.; H. W. Fluhrer, Oneonta, N. Y.; Geo. R. Fuller, Rochester, N Y.; G. G. W. Green, Johnstown, N. Y.; J. G. Ihmsen, Albany, N. Y.; H. F. McDonough, Newark, N. Y.; F. S. Rodenhurst, Clayton, N. Y.; F. C. Saunders, Wellsville, N. Y.; W. A. Seely, Waterville, N. Y.; J. H. Wright, Jamestown, N. Y. The elections were made unanimous.

A special vote of thanks was given to the manufacturers and supply dealers for making splendid exhibits and to Mr. Ihmsen for his indefatigable efforts in working up a successful convention. The following officers were elected for the ensuing year: Geo. R. Fuller, President, J. G. Ihmsen, Vice-President and General Manager, G. G. W. Green; Secretary, F. J. Brookman; Assistant Sec., Chas. M. Beattie, Treasurer.

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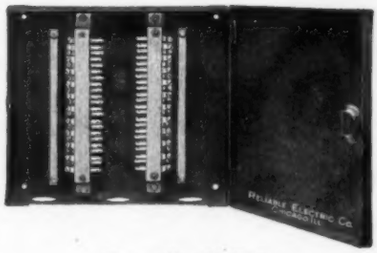

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PENNSYLVANIA MEETING.

Annual Convention at Harrisburg—New Officers—Business Transacted.

The Pennsylvania State Telephone & Traffic Ass'n. held its second annual convention at Harrisburg, January 12. Notwithstanding a severe storm on Tuesday before the convention, the registration was nearly 200.

The officers for 1922 are: President, H. E. Bradley; vice-president, E. D. Schade; vice-president, E. M. Prisk; secretary-treasurer, C. L. Baer.

The executive committee consists of: H. E. Bradley, E. D. Schade, E. M. Prisk, J. H. Wright, and C. A. Carl.

The following directors were elected: E. D. Schade, Johnstown; J. H. Wright, Jamestown, N. Y.; E. M. Prisk, Hazelton; C. A. Carl, Lancaster; W. S. Paca, Oil City; K. B. Schotte, Kittanning; J. F. Stockwell, Philadelphia; G. B. Rudy, York; J. Z. Miller, Erie; C. L. Baer, Harrisburg; H. E. Bradley, Harrisburg.

The annual report of Pres. Bradley showed that his association had had a very busy year. Not only were public utility bills carefully watched, but every one of the 2,067 measures introduced in the legislature were carefully analyzed, that nothing might be passed of harmful effect upon the telephone industry. He also referred feelingly to the new insect which has developed in the utility field—the "utility baiting lawyer," who is as active as the old "ambulance chaser," and always ready with ridiculous claims. In considering the question of rates, said Mr. Bradley, it is well to anticipate trouble. In the first place, make sure that you can justify the necessity for the increase. Then go after the support of your subscribers. Go before your chamber of commerce, your Rotary club, Kiwanis club or Lions club and prove to them that a rate increase is necessary. If you have increased your rates and become unpopular with subscribers, don't merely call their attention to the fact that the commission has allowed the increase, but prove to them the increase was granted to insure the kind of service they demand.

During the year 1921, $331,419.16 worth of business cleared through the association, or but $2,843.61 less than in 1920. Collections due from members have been reduced from $26,197.47 at the close of 1920 to $4,540.57 as of Dec. 31, 1921 and the association now owes members but $4,281.37 as against $37,643.01 at the end of 1920. Interesting reports were made for the Eastern district by E. M. Prisk and for the Western district by E. D. Schade.

J. F. Stockwell, operating manager of the Keystone Telephone Co., Philadelphia, spoke on "Automatic Operation of Multiple Exchanges," outlining the cut-over to automatic last May of six exchanges of the Keystone company in less than twelve minutes. The plant in Philadelphia consists of 2,275,000 feet of cable, 119,000 miles of wire, and 1,700,000 feet of duct space. Mr. Stockwell claimed that his company is handling 60 per cent of the business traffic of Philadelphia.

J. G. Ihmsen, general manager of the Upstate Telephone Association of New York, was introduced by President Bradley, and invited all to the New York convention.

John Z. Miller, of Erie, addressed the meeting on "Telephone Accounting and Collecting," a very helpful paper.

Cable Without Conduit

Well Known Telephone Engineer Reviews Some of Arguments For and Against Laying Cable in Trench without Protection--Summary of Advantages and Disadvantages Under Given Conditions

By R. L. Parker

In an effort to economize during the period of high prices, a number of telephone companies resorted to the experiment of laying telephone cables in the ground without protection of any kind and thus eliminating the cost of conduit construction. When the price of paper-wrapped cables dropped from war prices to a pre-war level, it seemed that the long-delayed reconstruction of the telephone plant should be undertaken at once. Other material and labor costs did not drop to the low pre-war level. Very naturally, under these circumstances, the practicability of laying cheap cable in the earth without protection received serious consideration.

The idea was not entirely new. It has been common practice to lay lead water pipes in the ground without conduit or protection of any kind. A telephone company in a Missouri town, which laid its telephone cables in the earth without conduits some eighteen years ago, has experienced no inconvenience and the cable is still in use. Many other instances of unprotected underground telephone cables proving satisfactory have been reported. The big idea of laying cable in the ground is the saving that is made in construction costs. The small company with limited capital can install with its available funds, double the amount of cable if it is laid without conduit. Small cable costs less than the conduit in which it is installed.

Arguments in Favor of the Plan.

There is much that may be said in behalf of this plan, especially in towns and villages where there is no heavy power or other electrical circuits using the ground for return. Buried cable should not be subject to injury by electrolysis. The lead sheath of the cable is in contact with the earth throughout its entire length and there is no particular point at which ground currents may be picked up by the sheath or leave it.

One great advantage which underground cable has over aerial cable is freedom from vibration and the constant bending to which the sheath is subjected during wind storms. Cable laid in the ground is not likely to be damaged by crystallization.

If unprotected cable is laid at a depth of from three to three and one-half feet below the surface of the ground no trouble will be experienced by compression from freezing. In the northland cable is sometimes ruined by the action of frost. If cable in conduit is close to the surface, water is liable to collect in low spots and freeze. As the temperature falls the ice expands and crushes the cable. The pressure sometimes becomes so great as to pinch the cable nearly in two and open the circuits. However, when laying cable without protection, precaution must be taken to avoid the possibility of water collecting at the bottom of riser pipes at terminal poles. Water should not be allowed to enter the riser pipe from the top. This may be accomplished by having a lead hood or cap wiped to the cable sheath and extended out over the upper end of the pipe. The lower end of the riser should be taken fully two feet below the surface of the ground.

Low in Cost From First to Last.

The cost of laying cable in an open trench is very low. It usually pays to turn over the digging of the trench to experienced tile ditchers. They will dig a better trench, keep it nicely to grade and do it for less money than inexperienced diggers. The bottom of the trench should be cleaned with a crummer and care taken to see that no glass or small rocks are kicked into the ditch before the cable is laid. Pulling in the cable is a very simple matter and does not require the preparation usually necessary for pulling into conduits. If plenty of water is used for settling the dirt as it is returned to the ditch, practically all of the debris may be put back and the expense of carting it away may be saved.

In setting up depreciation reserves it would seem that no junk value should be assigned to buried cables, especially in the case of small cables, as the cost of recovering them may equal their value. If this is true, then most of the manholes that would otherwise be used may be eliminated and the cost of the underground system thereby greatly reduced. Manholes would be needed only at important junction and splicing points.

Objections Against the Plan.

Among the objections offered to the plan of laying cable in the dirt is the liability to the lead sheath of being decomposed by chemicals and acid in the soil. It may be possible that chemicals dumped into the street might in some instances attack the lead, but the fact that lead water pipes seldom suffer from this source leads the writer to believe that this objection is of slight consequence.

The operations of the municipality in cutting down grades, conceivably, might expose the telephone cable to injury. To avoid this, the question of established grades and possible changes should be studied before the cable is buried. If a new grade is established at a later date, it should be possible by digging a deeper trench beside the cable, to lower the unprotected cable without injury. This, certainly, would be less difficult to accomplish than to lower conduit, which would be necessary under similar circumstances.

The difficulty in locating trouble and making repairs also has been exploited as an objection. Supposing a leak occurs in the cable sheath, either by an injury or a defective splice. The difficulty may be approximately located by making the regular tests. At a trivial expense for digging, the cable may be exposed in this vicinity and tests made with an exploring coil. When the trouble has been found, an excavation may be made sufficiently large to allow the repairs to be made without disturbing the cable.

One of the most common causes of injury to underground is carelessness on the part of men digging in the

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streets and alleys, in connection with work on sewer and water mains. Fibre conduit offers very little protection against these operations. The digger usually breaks through the conduit and injures the cable before he is aware of the nature of the obstruction he has encountered. To guard against this difficulty, the telephone company should secure an arrangement with the city authorities for notice when any digging in the streets or alleys is permitted or planned. If the city does not have an ordinance regulating and controlling the making of excavations in its streets and alleys, such an ordinance can usually be secured by bringing the advantages and need of such an arrangement to the attention of the city council.

Where Conduit Should be Used.

On streets that are paved or likely to be paved, it is undoubtedly advisable to use conduit, especially in the downtown section, as it is customary to pave these streets from sidewalk to sidewalk. In the residence district, the cable may be buried in the parking and conduit used only where it is necessary to cross under a paved street. Whenever paving is extended into new sections of the city, the telephone company should provide itself with conduit for future use. However, it is possible to drill under a pavement for sixty or even one hundred feet to make an opening for pulling in cable. Steel conduit may be forced under pavement for like distances.

Telephone companies who bury cables should not overlook the necessity of making accurately drawn maps or blue prints showing the location of their underground plant. The location of all splices and junctions should be shown. The advantages of knowing the exact location of every detail of the underground plant will be appreciated when trouble occurs.

Underground vs. Aerial.

Aerial cable may have its friends, but it costs money to put cable in the air, and unless it is given careful attion it is comparatively short lived. It is exposed to the ravages of the weather, to crystalization, stray and well-aimed bullets, heat from burning buildings, lightning, accidents to supports, house-movers, squirrels and some say cable lice. Buried cable has the advantage of low cost and is free from many of the hazards to which aerial cable is subjected.

MINNESOTA MEETING.

Many Interesting Features of the 13th Annual Convention—New Officers Elected.

The Minnesota Telephone Association held its thirteenth anual meeting at West Hotel, Minneapolis, January 24–25, with President H. F. Lueders, of Norwood, in the chair. The newly elected officers are as follows:

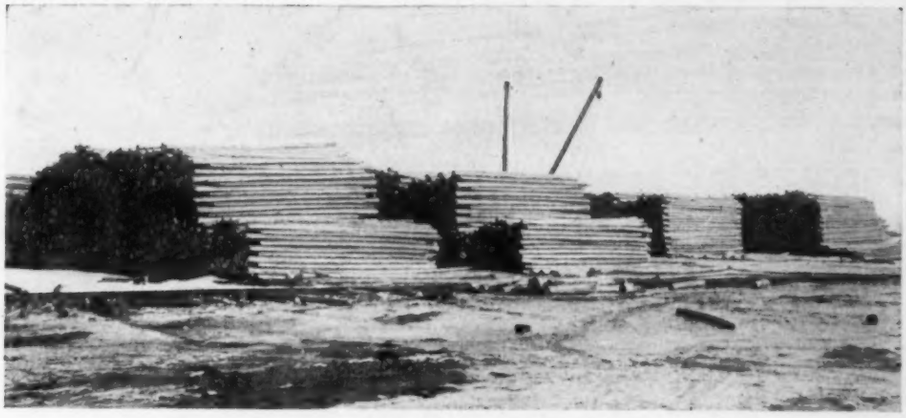
President, Jay Greaves, Glencoe; vice-president, E. P. Wright, Alexandria; vice-president, D. W. Gretorex, Blue Earth; secretary-treasurer, E. C. Kast. The executive committee consists of D. M. Neill, Red Wing; H. F. Lueders, Norwood; and D. W. Gretorex, Blue Earth. The old board of directors was re-elected, its members being: H. F. Lueders, Norwood; Thomas Vollom, Erskine; E. P. Wright, Alexandria; D. W. Gretorex, Blue Earth; Jay Greaves, Glencoe; P. M. Ferguson, Mankato; W. S. Clay, Hutchinson; Irving Todd, Hastings; F. D. Linquist, Fulda; and D. M. Neill, of Red Wing.

Features of the occasion were President Greaves' address, one on "The Toll Situation" by Roy F. Wilder, commercial engineer of the Tri-State T. & T. Co., and those of Prof. C. M. Jansky of the University of Minnesota on "Wireless Telephony;" of C. B. Randall, of St. Paul, general counsel of the Tri-State T. & T. Co. on "Depreciation" and of President F. B. MacKinnon of the U. S. Independent Telephone Association on "Telephone Problems." J. W. Howatt, telephone supervisor for the Minnesota Railroad and Warehouse Commission also spoke entertainingly of his experiences, and other talks were made by C. C. Deering, secretary of the Iowa association; E. P. Wright, of Alexandria; Thos. Vollom, of Erskine; D. M. Neill, of Red Wing; Senator J. A. Carley, of Plain View; P. M. Ferguson, of Mankato; Dr. F. W. Schofield, of Cannon Falls; and Secretary E. C. Kast. The National Carbon Co. and Automatic Electric Co. put on good moving picture shows to entertain the convention and helped with the following contributors to provide tickets for a memorable banquet and theater party: American Electric Co., St. Paul; Bell Lbr. Co., Minne-Chicago; Bell Lumber Co., Minneapolis; Burgess Battery Co., Madison; Cook Electric Co., Chicago; Electric Supply & Construction Co., St. Paul; Findley Electric Co., Minneapolis; French Battery & Carbon Co., Madison; Gopher Mutual Casualty Co., St. Paul; Gund Manufacturing Co., La Crosse; Indiana Steel & Wire Co., Muncie; Kellogg Switchboard & Supply Co., Chicago; Leich Electric Co., Genoa; Macoubrey-Rowlands Co., Minneapolis; Miller-Davis Co., Minneapolis; Monarch Telephone Mfg. Co., Ft. Dodge; Naugle Pole & Tie Co., Chicago; Northwestern Electric Equipment Co., St. Paul; Oshkosh Manufacturing Co., Oshkosh; Page & Hill Co., Minneapolis; Partridge Lumber Co., Minneapolis; Reliable Electric Co., Chicago; Runzel-Lenz Electric Mfg. Co., Chicago; St. Paul Electric Co., St. Paul; Sterling Electric Co., Minneapolis; Stromberg-Carlson Telephone Mfg. Co., Rochester; Telephone Advertising Co., Kansas City; and Valentine-Clark Co., Minneapolis.

IN ARKANSAW.

Eight Annual Meeting Provides An Interesting Programme—Next Meeting at Little Rock

The Arkansas Telephone Association, comprising 140 Independent companies and the Southwestern Bell Telephone Co., held its eighth annual meeting at Hotel Marion, Little Rock, January 16–17. The officers, re-elected by acclamation, are: Thomas Stahl, Siloam Springs, president; W. N. Graham, Clarendon, first vice-president; J. E. Armstrong, Russellville; second vice-president; and F. B. Sprague, Corning, secretary. After President Stahl's annual address and a talk on "The Outlook for the Telephone Business in 1922" by Secretary Sprague, "Relations with the Public" was discussed by Vice-President J. E. Armstrong, and A. J. White, of Little Rock, gave an illustrated talk on "Long Distance Transmission." The banquet Monday night at Hotel Marion was followed by a theater party as guests of the Southwestern Bell Telephone Co. On Tuesday the meeting heard these talks: "Better Maintenance of Telephone Plant," W. N. Graham; "What Is a Fair Return on Telephone Property?" L. M. Emerson, of Prescott; "The Operator," S. B. Wilson, of Cotton Plant; "Handling Long Distance Traffic," L. M. Loring, of Little Rock; "Ways and Means of Reaching a Better Understanding with the Public," L. L. Evans, of Atkins; and "Telephone Rates and Councils," E. B. Downie, of Little Rock. The mid-summer convention will be held in July at Hot Springs.



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We are emergency specialists. To assure quick service get in touch with the nearest House.

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Western Electric Company

OFFICES IN ALL PRINCIPAL CITIES

(Continued from page 28.)

rious trunk groups in and out of such exchanges. It was also found the economical plan in several exchanges, where the then existing central office equipment had reached the capacity of the building, to cut sufficient lines out of such exchanges (to others in the same or nearby areas) to make the then existing equipment sufficient to handle the increased traffic caused by unification. In other words, plans were set up to cut down the number of lines in such exchanges to fit the existing equipment rather than provide equipment to handle the estimated increased traffic.

A Number of Other Points Come Up.

The following gives in a general way some of the problems worked out by the Traffic and Plant Departments during the period of unification:

On the Traffic Department was placed the responsibility for recommending those changes in equipment which would tend toward the adoption of uniform operating practices and methods; the lining up of uniform methods of taking and summarizing peg counts, uniform number assignments and those miscellaneous items which come under switchboard records and facilities; the putting into effect of uniform operating methods and practices. (This item was considered very important as any changes in operating methods or practices had a bearing at all times on the operating force and in many cases upon the public. In either case, if the new method was not better than the old, it was liable to cause complaint and dissatisfaction either in the operating force or by the public); the introduction of uniform employment and student training practices, uniform service observing, uniform cafeteria service and prices, and uniform private branch exchange supervision; the combining of the two Traffic organizations of the two old companies into one organization capable of rendering unified service. Some of the more important details necessary to be worked out under this last item were as follow:

Realize the Details That Were Involved.

(a) Making force conditions uniform with reference to salaries, hours, reliefs and supervisory positions. Before the consolidation the separate operating forces had different conditions in the reliefs given, the number of hours worked per day on certain tricks, methods of paying, hours worked by the supervisory forces and the supervisory positions authorized. These changes were all worked out gradually in order to make all of these points uniform in the two systems, in each case the change being made to the practice which after full consideration it was felt was the best one to adopt. Many of these changes were placed in effect by holding meetings of the representatives of the operating force, explaining the situation to them and asking their aid in putting them through satisfactorily. How successfully this work was accomplished is reflected in the feeling between the supervisory forces and operators in that no complaint has been brought about by any of these necessary changes in force conditions.

(b) Training the supervisory forces to follow the same policies and methods of handling and training their people and the public. Different policies were followed by the supervisory forces of the old organizations in handling the public; also in handling and training their own people. Training these forces to think along the same lines and follow the same policies was a problem which required considerable thought and much time and attention.

(c) Training the operating forces to follow the same operating practices. This item was taken care of by drawing up an Operating Text Book which unified the practices of the two systems; then carrying on a series of classes of all the members of the operating forces until the new practices were placed fully in effect. To give some idea of what this meant, it was necessary that each central office hold meetings with some part of the operating force every day continuously over a period of three months.

(d) Training the operating forces in the changes due to consolidation, such as, for example, the changes in central office prefixes and the introduction of new prefixes, the introduction of zone service prefixes, the introduction of tandem call circuit work and built-up connections, the writing of A-B toll tickets, the introduction of initial zeros, etc. Some idea of what this meant to the operating force can be had when it is considered that in the twenty-nine months during the period of unification, there were practically only six months when some part of the operating force was not affected by such changes. These changes were taken care of by having in each office an instructress who explained the new practice to each operator and supervisor.

(e) Providing and training a sufficient number of new people to handle the increased traffic due to the unification. This at the beginning of the period of unification was perhaps the biggest problem which confronted the Traffic Department as it appeared impossible to obtain a sufficient number of new people; in fact, during the first eight or ten months the operating force lost instead of gaining in numbers and experience. Since the summer of 1920, however, this problem has not been so acute, although a sufficient number of desirable people have only been obtained during the last few months to cover the requirements.

(f) Watching the improvement in service, constantly. This was always before the Traffic Department and such improvement was made that subscribers' complaints were far below the usual number for an exchange as large as Kansas City.

Other Joys of the Plant Department.

On the Plant Department also was placed the responsibility of supplying the trunk wire plant, wire distributing systems, the re-arrangement of its force to maintain the plant in regular operation and carry on the necessary new construction and in addition, the training of a special force to handle the automatic unit as cut into service. It required approximately 1,500,000 conductor feet of cable pairs to supply the additional interoffice trunk circuits. The complete inter-office trunk layout requires 8,000 trunk pairs. In order to effect certain economies in outside plant it was found desirable, due to the large amount of nineteen-gauge cable in use on the Home system, to install twenty-two-gauge cable for subscribers' line loops and use the nineteen-gauge cable pairs for interoffice trunks. Approximately 1500 P. B. X. and intercommunicating systems were rearranged or changed. Nearly 7,000 lines have been cut from one office to another in order to adjust boundary lines and maintain an economical distribution of central office equipment.

The work of unification was carried on under the direction of J. G. Crane, Vice President and General Manager, and W. C. Polk, Consulting Engineer. The co-ordination of all major operating and engineering work was directed by Mr. Crane, as was also the passing upon of all preliminary plans for major items affecting both the unification and operation of the property, all plans and estimates originated by the organization being passed

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upon by Mr. Polk. The direction of all public relation work was carried on by H. L. Harris, Vice President. The personnel of the department heads carrying out this successful unification is as follows:

W. C. Kavanagh, Secretary and General Auditor.

H. W. Ritterhoff, General Commercial Superintendent.

C. J. Larsen, Building and Equipment Engineer.

C. M. Martsolf, General Traffic Superintendent.

W. N. Faust, General Plant Superintendent.

H. E. Gwillim, Traffic Engineer.

The headquarters of the Kansas City Telephone Co. are located in the Telephone Building, 11th and Oak Streets, Kansas City, Mo. Also located in this building is the first 10,000 line automatic (panel type) unit and toll boards handling lines of the American Telephone and Telegraph Co., Southwestern Bell Telephone Co. and the Kansas City Long Distance Telephone Co.

FOR SALE: Telephone exchange of about 600 phones. Entire system in first-class condition. Location, Oklahoma. Will sell so it pays thirty per cent net. Ask Hugh Conner, Hutchinson, Kansas.

Illinois Telephone Association Meets With Galva's Chamber of Commerce.

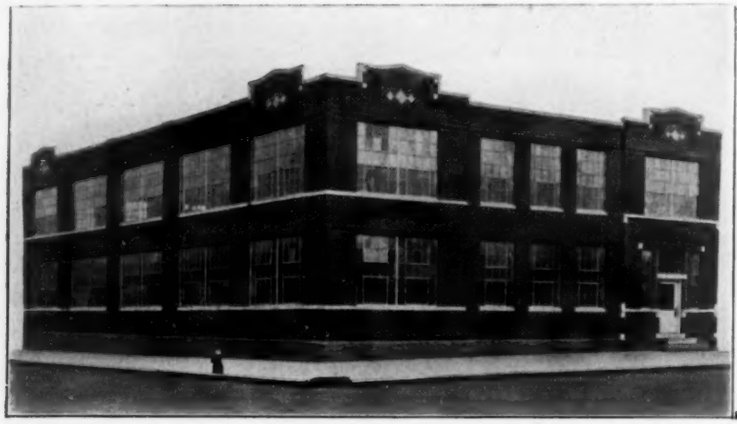
The Illinois Telephone Association held a successful district meeting in the First National Bank Bldg. at Galva, Ill., January 11, attended by some 40 operating men. Louis Pitcher, of Dixon, acted as chairman. Secretary Mitchell spoke on publicity and co-operation, emphasizing the value of district meetings. He suggested that joint meetings be held with Kiwanis, Rotary, and other commercial clubs wherever rates need to be adjusted and public relations improved. The importance of educating the public was discussed by Vice-president E. S. Sterret, of Henry, who declared that the business has developed to a point where subscribers demand a service that requires rate increases. The meeting was then turned over to R. F. Dexter, of Galva, in charge of arrangements, who spoke on the importance of Independent companies building and developing their own toll lines. H. B. Hamline, wire chief of the Galva Telephone Co., also presented suggestions on pooling lines for maintenance purposes. It was decided that if the lines were properly kept up, a good toll business could be developed. The questionnaire of the Interstate Commerce Commission was discussed. There was also an informal question box. Miss Anna Barnes, traveling chief operator, Iowa Independent Telephone Ass'n., Des Moines, conducted an operators' school attended by about 40. At night the Chamber of Commerce of Galva held a special meeting at which Jay G. Mitchell talked on the telephone business.

Johnstown, Pa. Company Takes Over Another Property.

Johnstown, Pa.—Under a long term lease the Huntington and Clearfield Telephone Company's system has been taken over by the Johnstown Telephone Company.

Business Not So Bad; Brandon, Wis., Dividend 10 Per Cent.

Brandon, Wis.—At the annual meeting of the Brandon Telephone Company a 10 per cent dividend was declared. Officers of the company were elected as follows: President, H. L. Brown; Vice President, F. G. Henske; Secretary and Treasurer, F. R. Schwandt.



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SERVICE MAKES RATE.

Michigan Commission Says Quality and Value of Service Determine Rates.

Lansing, Mich.—Telephone companies equipped to give good service will find their facilities arguing for them in actions for higher rates, according to a decision made by the Michigan Public Utilities Commission in a recent case.

A Lansing dispatch says:

"The commission refuses to accept original cost, or reproduction cost, less depreciation, as a rate base and insists that the only proper rates are those based on value and quality of the service.

"The commission's stand, as expressed by William W. Potter, commissioner in charge of telephone matters, is that the properties of the company pleading are partly antiquated. He says the subscribers cannot be required to pay a return on obsolete equipment. One thing pointed out as obsolete, on the basis of the company's own testimony, is a switch board.

Fair Return For Service.

"The question in which the public is interested," Mr. Potter declares in his opinion, "is the quality of the telephone service rendered. All admit that they should pay rates sufficient to enable the telephone company to earn operating expenses, maintenance and repairs, taxes, depreciation and a fair return on fair value of the property used in the public service.

"On the other hand, the public ought not to be compelled to pay an excessively high rate of return upon inflated values arbitrarily placed on near obsolete equipment.

"What a telephone property is worth must be determined largely by its capacity to render economic and profitable service. The fundamental theory of the cost of reproduction less depreciation method of valuation is not what it might cost to reproduce obsolete or near obsolete equipment, but what it would cost to produce equipment that will produce service of the same quality as that being rendered by the equipment under consideration.

"If property costing less can, by the use of the same labor, produce better service than the property under consideration then it is worth more. The test of the reasonableness of telephone rates is not that such rates yield a fixed return upon the original cost or the cost of reproduction less depreciation of the property of the telephone company, but whether such rates yield a fair return for the service rendered. Does the public get what it buys and pays for? Does the telephone company receive just compensation for the service it sells and delivers?"

Wants Congress to Help the American Wood Preservers.

C. S. McKinney, of 5 Nassau St., New York City, is one of America's pioneer wood preserving specialists. In a recent letter, he says: "If Congress does not prevent Germany from dumping her trashy stuff in our country, the wood preserving business here will be of not much value."

F. J. Dommerque, Director of Foreign Development for The Federal Telephone and Telegraph Co., of Buffalo, N. Y., now is located in the Woolworth Building, New York City.

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Buy it of your jobber in ½-lb., 1-lb. and 5-lb. blue and white enameled cans and 50-lb. cans.
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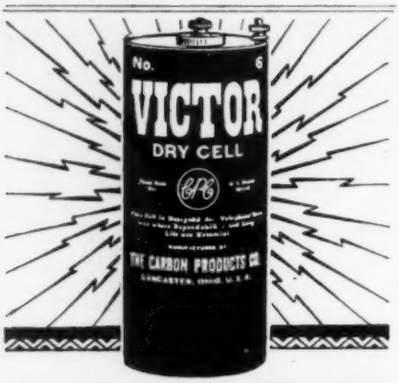

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NEW REVENUE.

Telephone Advertising Idea Sells Ad Space On Instrument

Kansas City, Mo.—A new advertising idea that takes advantage of the conspicuous location of the telephone and its importance in shopping has been introduced with success by a Kansas City firm, the Telephone Advertising Company.

The new advertising medium is a round disc that locks on the transmitter, behind the mouthpiece, and keeps the advertisements upon the disc's surface prominently in view.

Several hundred designs were tried out before they obtained one so artistic it could give no offense, say the sponsors of the idea.

A contract is made with the telephone company which guarantees the installation of a certain number of discs on local telephones. Discs are renewed, whenever visits of telephone company employees indicate the advisability of such renewal. There is no investment required of the telephone company.

Sale of advertising space on the instruments has been approved by many telephone companies and officials in the middle west, according to the Telephone Advertising Company. All solicitation of advertising contracts is done by the Telephone Advertising Company's own men, and a rigid censorship is maintained over the class of the advertising appearing, it is claimed.

The idea was one of the features of the recent Minnesota State convention, and its backers say it received favorable attention from the telephone men at this meeting.

"Touch Not a Single Bough!"—Jury Endorses Edict.

Belleville, Ill.—City officials, prosecuting residents who prohibited telephone companies from trimming trees that interfered with phone service, lost their case. Jury decided wires of the telephone company ran over the resident's property instead of on public property. The poles' locations now will be changed.

Illinois Bell Will Spend Two Millions on New Plant.

The Illinois Bell Telephone Co., January 25, approved an expenditure of $1,933,593, for new plant, in Chicago and other parts of Illinois.

UNIQUE CROSSING.

Quick Sand Presents Problem Engineers Solve By Pipes and Poles

Mustang, Okla.—Another interesting experiment is under way to attempt to harness the arbitrary South Canadian River at Mustang, Oklahoma. The river at this point is very wide, with a bed of shifting quicksands, which easily wash out or change considerably at every high water. Such a complex physical condition is the cause of concern to any construction engineer. Last summer and several times previously, when the river was exceptionally high, the line of the Southwestern Bell Telephone Company, the Frisco bridge and oil pipe line were washed out.

In order to prevent a recurrence of interrupted service, Bell telephone engineers are proposing to construct a novel wire crossing at this place, with the hope that it will be able to withstand the enormous force of the flood waters.

Fifteen-inch casing pipes, similar to those used in oil wells, will be sunk 50 to 60 feet deep in the river bed, down to solid rock. Fifteen feet above the bed rock is a four-foot vein of shale, which it is hoped will act as a brace for the pipes. These pipes will be filled with reinforced concrete to the tops, which will extend above high water mark. To these sunken pipes will be attached 30-foot telephone poles of the largest size obtainable. Thus the telephone line proper will be above high water mark, but anchored 60 feet deep to solid bed rock, and braced by a 4-foot vein of shale.

Success of the new construction can only be determined by the next unusually high flood.

Official October Figures Show 37% Increase in Income.

Washington, D. C.—Government statistics on telephone companies having annual operating revenues in excess of $250,000, aggregated $9,463,264 in October, 1921. This is an increase over the corresponding month in 1920 of $2,557,630, or 37 per cent.

New York Has $244,574,000 Invested in Plant.

New York City—Testimony of H. A. Trax, chief accountant of the New York Telephone Company before the Public Service Commission states the utility's investment in the state is $244,574,000.